PLASTICS

A Periodical Devoted to the Manufacture and Use of Composition Products

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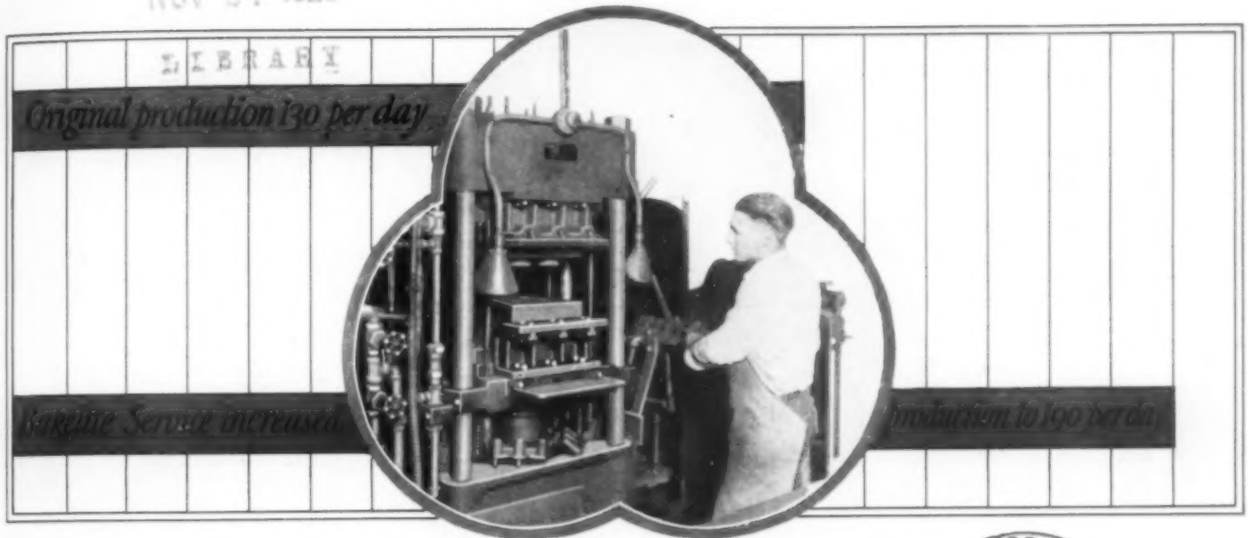

Over 45 percent increase in production through Bakelite cooperation

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Molded Products

See Page 335

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PLASTICS
& MOLDED PRODUCTS

A periodical devoted to the manufacture and use of plastic and composition products

Vol. 4 JUNE, 1928 No. 6

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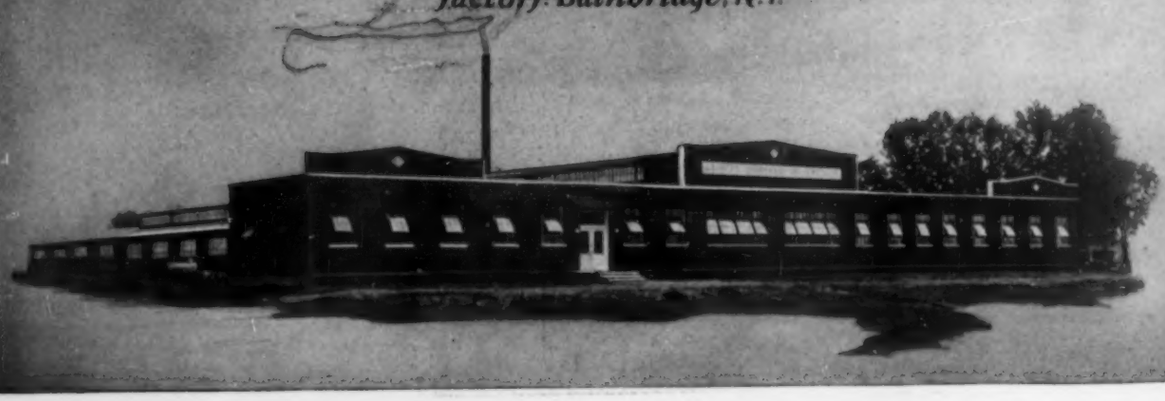


PLASTICS

A periodical devoted to the manufacture and use of plastic and composition products

Vol. 4 JUNE 1928 No. 6

Fusing and Dissolving the "Infusible" and "Insoluble" Resinoids

Though not much work has been done on this phase of resinoid chemistry, what there is of it points the way for the utilization of flash and other waste

By Charles W. Rivise

LL.B., B. S, in Chem. Eng., M. P. L.

The author of this article has combed the literature relating to this art particularly in the field of patents, and has culled from his store of information some of the less well known methods and processes.

His long association with the United States Patent offices places him in an especially favorable position to acquire an intimate knowledge of the progress achieved in the patented synthetic resin art.

THE phenolic condensation products particularly in their ultimate, fully polymerized form though somewhat disintegrated by the alkalies and strong nitric and sulphuric acids, are infusible and insoluble, unaffected by oils, practically impervious to water, and unattacked by dilute mineral and organic acids. To this physical and chemical inertness so characteristic of the Bakelite resins, is due in a large measure the wide and ever enlargening range of their industrial usefulness. And yet this valuable property which is their greatest asset as well as selling point, is not only responsible for many of the difficulties that have been and are being daily encountered in their commercial utilization, but has also kept the resin art in its infancy for many years after its inception about 1904.

Early Beginnings

It will be remembered that Baeyer and his pupils first stumbled across the resinous products of the phenols and the aldehydes in 1871 while seeking to increase the number of known crystalline substances. Some of the products appeared to be infusible and insoluble and therefore escaped chemical identification. Attempts to control the reaction to produce soluble and fusible products were of no avail and unexpectedly different results were obtained while working under seemingly similar conditions. The early investigators therefore considered the product worthless and consigned their test tubes to the waste can.

More than thirty years elapsed before Baekeland, Aylsworth and other independent painstaking and persistent workers solved the riddle that opened the art to its present rapid development. Their contributions which made the product useable in the arts can be summarized as follows:—

(1) Control of the *reaction* between the phenol and aldehyde so as to cause it to stop at an intermediate stage producing a resinous, soluble, fusible product, which can be stored for further use, but which is potentially reactive and promptly transformable by heat into the final and insoluble, infusible form.

(2) Production of a two step resin, the first step of which is the production of a fusible phenol resin and the second, the transformation of this resin into the infusible product by reaction with a substance containing an active methylene group.

Resinification

For reasons that are not within the scope of this article, the principal method in use today is the one in which the reaction is controlled so as to stop at an intermediate fusible stage. The product is then mixed with fillers or modifying agents, molded to desired form or used as a varnish or impregnating

agent and converted to its ultimate infusible form by heat.

Absolute control has not yet been attained in spite of the many patents directed toward this object. Hence, the product is very seldom uniform and several batches must be mixed to produce anything like a uniform product. Furthermore, it often happens that a batch is overcured to such an extent that it is absolutely useless and must be discarded. Attempts to prevent overcuring usually result in incomplete polymerization leaving uncombined reagents within the product, many of which detract from the desirable qualities of the product as well as impart unpleasant odors thereto.

Need For Further Work

From what has just been said, it would follow that there are two developments still needed in the synthetic resin field:—

First; a practical method of making the fusible product without the controlling feature of the present methods; and

Second; a cheap process of reclaiming unintentionally overcured resins.

A careful study of the entire patent literature covering nearly 1000 United States patents brings to light only a very few patents with either object in view. The one to Aylsworth, No. 1,027,794 dated May 28, 1912 is of special interest for not only is it the first along this line, but it also discloses one apparently feasible method for the solution of both problems. This double feature is due to the fact that Aylsworth's method consists in carrying the reaction between a phenol and an aldehyde to the final infusible, insoluble stage and then reconverting the product to the intermediate fusible form.

Specifically, the method consists in treating phenol and a 40% solution of formaldehyde together with a small percentage of either an acid or basic accelerator or catalytic agent and allowing them to react rapidly to form the ultimate product in the form of an infusible porous mass. This mass will be porous because of the evolution of gaseous products which necessarily takes place when the reaction between the phenol and aldehyde is caused to rapidly ensue at an elevated temperature and under no counteracting pressure. However, in this process this is not a disadvantage, because of the subsequent treatment of the mass.

A review of some of the very early patents on casein plastics, the result of the pioneer work of Byron B. Goldsmith will appear in the July issue of Plastics.

The response received from our readers in connection with the "Old Process" department prompts us to continue this feature of our service to our readers.

The porous mass is preferably crushed, pulverized and then baked at approximately 350 degrees F. whereby entrapped water and acid vapors are expelled. The powered and dried substance is mixed with phenol or cresol in approximately the proportion of two parts of the final condensation product to one part of the phenol and heated in a closed vessel under its own pressure at a temperature of from 450 Degrees to 550 Degrees F. for several hours. By this treatment, the ingredients of the mass go into the solution with a chemical change, whereby the product reverts or is broken down to the fusible resin, presumably by reduction of the formaldehyde element.

Reconverting Agents

Phenol and cresol are the preferred reconverting agents, but other similar substances may be used, such as a mixture of phenol and naphthalene, in which case the naphthalene may be removed by distillation after the solution is formed, if desired.

There are several well-defined advantages inherent in the above method. The ingredients need not be accurately weighed out and the reaction can be carried out very speedily since no control need be exercised in producing the infusible resin. Furthermore, the method is applicable for the re-utilization of scrap material as well as discarded and imperfect articles.

Albertols

Ludwig Berend of Germany also has made some valuable contributions toward reconverting the the infusible product into fusible products as is evidenced by his Patents No. 1,205,081 dated November 14, 1916 and No. 1,259,347 dated March 12, 1918. The purpose of the first patent is stated to be the devising of a method for making phenol aldehyde resins soluble in oils so that the product can be used in varnishes, but it is incidently stated that infusible resins can be reconverted into fusible resins by heating with natural resins at normal or increased pressure. The product of this patent is on the market under the trade-mark of Albertol.

Use of Natural Resins

The second patent, namely, Patent No. 1,259,347, which has some subject matter in common with the first patent, is directly concerned with rendering infusible resins fusible by heating them with natural or synthetic resins of various kinds, including those that are usually used as fillers under reduced, ordinary or increased pressures with or without admixture of acids or acid salts as contact means. This appears surprising in view of German Patent No. 214,194 in which it is recommended that acids and acid salts be used to accelerate the hardening. However, basic or neutral salts may also be used as catalysts.

For example, coarsely powder-

(*Continued on page 326*)

Molding Highly Colored Definite Designs and Patterns

Cellulose acetate molding powder in conjunction with woven cellulose acetate fabrics enables the production of highly novel and ornamental effects

THIS invention relates to a new process for the manufacture of patterned or effect materials, sheets, slabs, blocks or other articles or objects of any shape in materials having a basis of cellulose acetate, nitrocellulose, ethyl, methyl or benzyl cellulose or other plasticizable esters or ethers of cellulose mixed or associated with a plasticizing agent or agents, with or without other additions.

Any Cellulose Ester

Patterned or effect materials, articles or objects are those which present in their substance any desired patterns, designs or effects, for instance colored or other imitations such as tortoiseshell, marbling or veining, or ornamental designs, patterns and so forth of any color or colors. The invention concerns processes of the kind in which the materials, articles or objects are made by subjecting to molding under heat and pressure molding powders consisting of or containing cellulose acetate, nitrocellulose or other plasticizable esters or ethers of cellulose (or two or more of such cellulose derivatives) mixed or associated with a plasticizing agent or agents, with or without other ingredients such as fillers.

The present invention employs as a means for producing patterns or effects in or upon the materials, articles or objects,—knitted, woven or other fabrics composed of yarns or threads consisting of filaments or fibres of cellulose acetate or other cellulose derivatives. Such fabrics are printed, stencilled, dyed or colored suitably for the pattern or effect to be produced, and are placed in or upon the molding powder and subjected together therewith to molding under heat and pressure in the usual way.

The desire to be able to produce highly colored and decoratively patterned molded articles, such as would successfully compete with the pyroxylin plastics and the casein solids has been the desire of molders of resinoid materials since the inception of this industry. While very pretty mottled goods and some bright colors, more or less solid, however, have been achieved, there was, up to recently, no method by means of which, effects having distinctive patterns could be obtained by molding.

Apparently the difficulty has at least partly been solved by a process described early this year, and worked out by William A. Dickie and James H. Rooney, who assigned the patent on the process to the Celanese Corporation of America. (U. S. P. 1,655,677; Jan. 10, 1928).

The fabrics are preferably coated or impregnated with or contain a plasticizing agent.

In the molding operation the fabric melts or coalesces with the fused mass formed by the molding powder, so that its structure disappears in the molded material or article, while leaving the colored effect, pattern or design thereon.

Materials, articles or objects can be very reliably produced with patterns, designs or effects of any desired character, while avoiding or greatly reducing the disadvantages previously encountered in the manufacture of patterned or effect materials or articles from molding powders. Such difficulties as the liability of the pattern or design to run or blur under the effect of the heat and pressure required to cause the molding powder to flow and condense to a homogeneous mass in the molding operation, and the liability to produce too brittle and non-homogenous products are thus overcome by this process.

Use of Fabrics

In carrying out the invention, the fabric may be employed in a single piece or in any desired number and arrangement of pieces according to the pattern, design or effect to be produced in the material.

For instance layers or pieces of the fabric may be disposed alternately with layers of the molding powder, or a single layer or piece of the fabric may be interposed between layers of the molding powder. Where desired the fabric may be disposed on a layer of the molding powder or be spread with a covering thereof, or any number of pieces of the fabric may be arranged in any desired order and position relatively to each other in the molding powder. Any other appropriate arrangement may be adopted according to the pattern, design or effect desired.

In some cases one may even employ a fabric dyed or printed in a uniform color, so as to produce a corresponding pattern of this color on the material or

(*Continued on page 328*)

The Patent History of Composite Gear Wheels

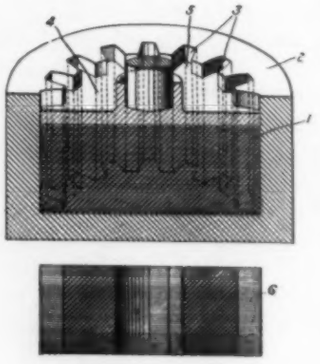
A chronological history of the development of resinoid impregnated fabric gear blanks

By Joseph Rossman

B. S. in Chem. Eng. LL. B. M. A. M. L. P.

In the May issue the general aspects of the molded gear art were discussed in their relationship with the United States patent art. The present part of the story comprises a chronological review of the diverse patents.

Continued from page 269 of Vol., 4 (May).



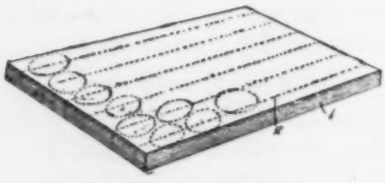
U. S. P. 1,223,348

OTHER patents on the production of noiseless gears are:

5. Conrad 1,167,743. Jan. 11, 1916.

A gear having a self-sustaining working body portion composed of laminations of cloth, such as muslin and a phenolic condensation product.

6. Johnston 1,173,433. Feb. 29, 1916.



U. S. P. 1,173,433

The process of making gear blanks from textile and felted fabrics, which consists in superimposing strips of convenient length and width in piles, then binding the layers together with lines of stitching spaced apart less than the diameter of the gear blank, and cutting out the blank of a plurality of layers in one operation, then superimposing a plurality of blanks and compressing them into a single gear blank.

7. Talley 1,223,216. Apr. 17, 1917.

A molded gear composed of textile fibrous material and a binder comprising a phenolic condensation product. Phenolic resins or other binders are intimately mixed with fibrous materials having long fibers and are molded under the proper conditions. Gears and other machine elements may be produced having working body portions which are entirely self-sustaining under the conditions of service and which, therefore, require no end plates or other reinforcement. Many kinds of fibrous materials are suitable such as long and short staple raw cotton, hemp and other textile fibers, as well as certain varieties of long-fiber asbestos. Phenolic condensation products, in their soluble stage, are used as binders, methyl alcohol may suitably be employed as the solvent. The binder may also be applied to the fibrous material in the form of powder sprinkled among the fibers. The prepared molding material is formed into gear wheels, pinions and other machine elements by compression in a hot mold according to the methods well known in the molding art.

8. Bastian 1,223,348. April 17, 1917.

The process of making a gear that comprises forming blanks corresponding in outline to shape of the finished gear from fibrous sheet material such as cotton duck impregnated with a phenolic condensation product, superposing a plurality of the said blanks and applying heat and pressure to the superposed blanks while confined in a mold conforming in shape to the finished gear.

9. Starker 1,253,294. Jan. 15, 1918.

A gear comprising a toothed working body portion composed of superposed laminations of fibrous material united by means of a binder comprising a phenolic condensation product, and a plurality of metallic re-inforcing plates disposed within the

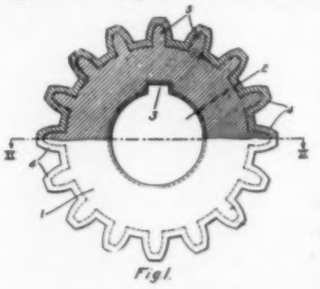
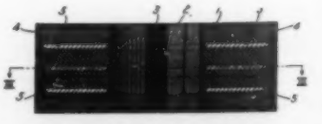


Fig 1.



U. S. P. 1,253,294

said working body portion and conforming in outline to the teeth of the gear but not exposed at the surfaces thereof. The reinforcing members may variously consist of punchings of steel, brass or other sheet

metal, or may consist of wire netting or other metallic or non-metallic material capable of adding strength to the gear.

10. Guay 1,275,906. Aug. 13, 1918.

The method of manufacturing blanks for gears, rolls, etc., which comprises forming a cylindrical body of loose unwoven textile fibers, all of said fibers being arranged to extend outwardly from the axis of the body and at different angles so that the fibers cross each other impregnating the body with water and a binder of ammonia shellac confining the body against change of shape in a plane perpendicular to its axis and subjecting the body to heavy axial pressure to consolidate it and drive out the excess binder.

11. Headson 1,180,495. April 25, 1926.

A gear comprising fibrous asbestos, cementitious material containing rubber, barytes, and sulfur, all compressed together to a density in excess of the normal density of the mass and vulcanized.

12. Stevenson 1,298,816. 1, 1919.

A molded gear of the indurated type, said gear being formed from commingled and entangled cotton fibers impregnated with condensation products of phenol and formaldehyde, pressed and molded to form the teeth and body portion as a unit and in one operation. The phenol and formaldehyde condensation product may be employed either in a liquid or in a dry state.

13. Kempton 1,309,757. July 15, 1919.

A method of manufacturing a composite article which consists in molding together under heat and pressure plurality of layers of fibrous sheet material impregnated with Bakelite and a body containing a comminuted or shreaded filler and Bakelite.

14. Thropp 1,310,899. July 22, 1919.

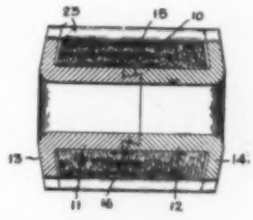
A pinion consisting of a series of sections clamped together, each section being made from a composition in which asbestos fiber is the base with sections of wire, preferably brass, cotton fiber and a vulcanizable rubber binding.

15. Wright 1,315,896. Sept. 9, 1919.

The method of forming noiseless gear which consists in forming segments from a compressible material such as paper or fabric previously treated with a phenolic condensation product binder, placing these segments in broken-jointed laminations around a solid center or core, and finally compressing them to make a solid homogeneous mass.

16. Carver 1,340,011. May 11, 1920.

The object of the invention is to provide an improved metallic holder for gears, rolls and the like of this general type which



U. S. P. 1,340,011

can be readily applied to the compressible element to hold it under compression and which will be very strong and rugged. It consists of an annular body element of compressible material, a holder comprising two parts which are located within the bore of said element with their edges meeting therein, said parts having flanges which engage said body element, and an annular tongue and groove connection between said meeting edges, said tongue and groove having inclined engaging surfaces which serve to draw the parts of the holder together when the same is being assembled.

17. Talley 1,341,685. June 1, 1920.

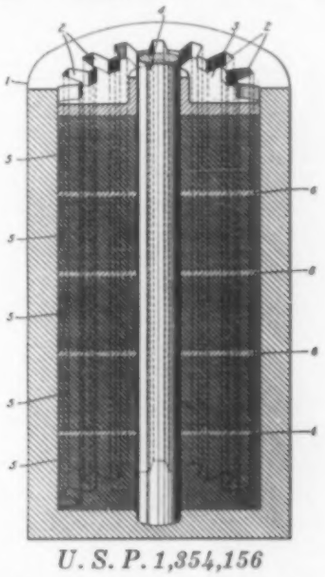
The method of forming a bevel gear or pinion blank which comprises superimposing layers of fibrous sheet material impregnated with a phenolic condensation product to provide a planiform body, bending portions of the sheets to create an outwardly flaring peripheral flange upon the body and subjecting the body to heat and

U. S. P. 1,341,685

pressure while the sheets are thus bent to compact it and harden the binder.

18. Bastian 1,354,156. Sept. 28, 1920.

The process of producing molded gears that comprises superposing in a mold having a cross-sectional outline, conforming in shape and size to the



U. S. P. 1,354,156

finished gear, a plurality of separate bodies of moldable material severally consisting of stacked laminations of fibrous material associated with a binder comprising a phenolic condensation product, interposing separating material between the bodies, and applying pressure simultaneously to all the superposed bodies. The binder may consist of any other suitable adhesive substance, such as the varnish gums and gum resins, among which may be mentioned shellac, kauri, copal and the like. The absorbent portion of the molding mixture may consist of loose fibers of asbestos, cotton, hemp and the like and may contain suitable reinforcing plates or wires if such reinforcement is desired.

(*Continued on page 332*)

World Trade in Plastic Materials

Northern Europe: The Netherlands

Official Statistics From The Department of Commerce

By C. C. Concannon

Chief Chemical Division, Bureau of Foreign and Domestic Commerce

THE development of a plastic industry in the Netherlands has been retarded, due chiefly to the fact that domestic consumers of these products are limited and that most of the finished plastic products are imported from Germany. There is only one plastic manufacturing plant in the country, which, it is estimated, supplies about 5 per cent of the small local consumption. This plant produces pyroxylin plastics from which it makes articles such as dolls, balls, and other toys, as well as toilet ware and drawing triangles.

These finished products are sold by the manufacturer to the wholesalers and retailers, while small quantities of pyroxylin sheets are supplied to the automobile body makers, bicycle factories, and the shoe industry. Smaller amounts of plastics are also supplied to a few radio and smoking pipe firms.

Another reason why a local plastic industry has not been developed to any considerable extent is due to the small size of the country and the unimportant local industrial consumers, resulting in a small turnover. One of the local firms estimates that the total domestic business in plastics does not exceed $100,000 per year. On the export side it would also be difficult for the development of a large Dutch plastic industry due to the high import duties in neighboring countries.

The information reproduced here is published by special permission, and represents reports produced by the various trade commissioners of the American Government stationed in the countries regarding which they write.

The article on The Netherlands is by C. Gorter.

Domestic Trade

The official Dutch statistics do not mention the trade movement of plastics other than pyroxylin in sheets. No business is conducted in plastics in rods, tubes, nor molding compounds in powder form. The usual terms in which plastics are sold in this country are payable after six weeks from date of invoice.

Imports

The bulk of the local consumption is supplied through importation. It is estimated that Germany supplies about 50 per cent while France supplies about 30 per cent of the local consumption. The remainder is supplied by the domestic producer as well as by Belgian and British concerns. The current price for pyroxylin sheets of German origin is approximately $.45 per pound ,whereas the French product is now being quoted at approximately $.30 per pound, which is about the same price as quoted for the domestic product. Great Britain supplies a small quantity, but of more expensive quality.

The Dutch import duty levied on pyroxylin sheets which can be used as substitutes for glass, amounts to 5 per cent ad valorem. Colored pyroxylins, painted or provided with figures and symbols, 8 per cent ad valorem. Plastics in bars, and tubes, provided they cannot be used as a substitute for glass, free.

The Netherlands is exporting some pyroxylin sheets and offal, chiefly to Great Britain, Belgium, Austria, France, Germany and Canada, but most of these exports are probably of German origin. Rods and tubes are not exported.

The following is an analysis of the import and export trade for the last four years:

Celluloid (exclusively of articles made therefrom) except casein and synthetic plastics which are not mentioned separately.

Statistics

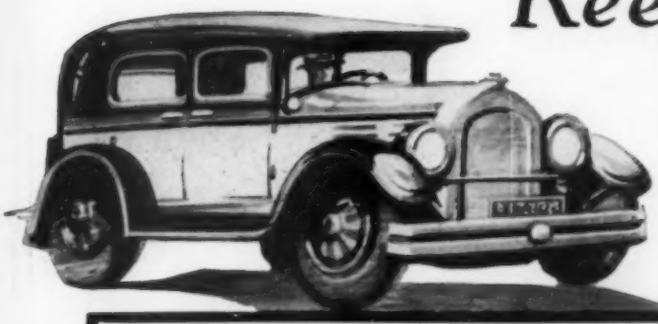
	Imports		Exports	
	Metric Tons	Florins	Metric Tons	Florins
1922	33	57,824	30	60,539
1923	35	48,159	78	265,501
1924	58	74,950	100	320,307
1925:				
Germany	18	51,342	5.5	3,582
Belgium	3	2,155	17	31,973
Great Britain	21	26,071	72	272,502
France	10	7,452	14	42,680
Sweden	..	.....	1	3,524
Poland	..	.....	2	6,220
Australia	..	.....	15	53,600
Ireland	..	.....	1.5	6,000
Canada	..	.....	2	5,475
Total for 1925	52	87,312	131	432,275

Competitive Products

No important industry in the Netherlands consuming materials competitive with plastics, such as wood, horn, or hard rubber, exists. The radio industry, however, consumes ebonite (hardened rubber) for the manufacture of front panels for receiving sets. No synthetic resins as yet have been substituted for this material. Knobs for variable condensers are also manufactured from ebonite, as well as loudspeakers in the form

(*Continued on page 330*)

Keeping Pace with Industry.



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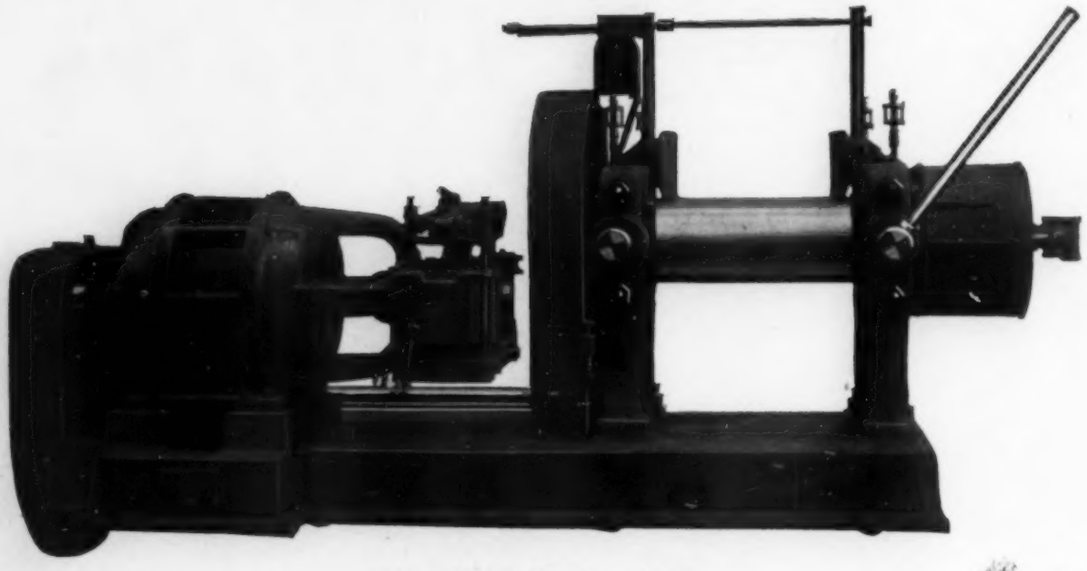

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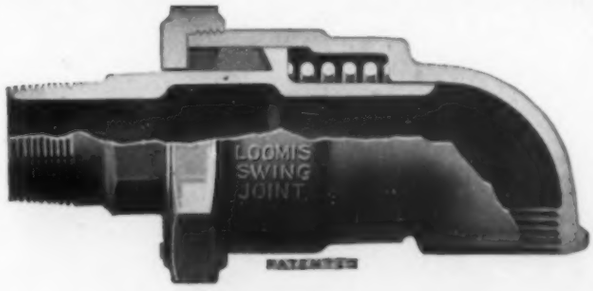

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Mechanical Properties of Resinoid Plastics

Colloid Chemical Aspects of Condensation Products

Effects of different methods of polymerization and physical conditions on the synthetic resins

By O. Manfred and J. Obrist

A communication from the German Technical High School at Brunn, Czechoslovakia

In the March, April and May issues of PLASTICS, *we have brought to our readers the first article by the present authors on the Mechanical Properties of Plastics, and how these properties are related to the chemical nature and mode of treatment of the raw material from which the plastics are derived.*

Thus far the discussion has mainly been with regard to the casein solids. The effect of Plasticizing upon the Mechanical and Elastic Properties of the Artificial Resins is considerably more involved and difficult. The series of articles beginning with the present issue throw a great deal of light on this subject, and are of much value to those who are developing resinoids, and are interested in their application.

The original article appeared in the "Kolloid-Zeitschrift", 1927, Volume XLII, No. 2; and is translated from a reprint kindly furnished us by the authors.

THE fundamental principles upon which the considerations expressed in the present article are based, have already been fully discussed in connection with the casein solids. Basically, the points brought out were that the plastic properties of materials is vitally affected by the degree of dispersion of the material when first comminuted, and the degree of reaggregation of the particles and their orientation in the finished material. The differences in elasticity, as well as other mechanical properties, when plastic substances are tested longitudinally and transversely can well be explained on the basis of the theories presented, and supported by numerical data.

Nature of Plasticity

A concept which has been shown to be fundamentally correct is that all substances that exhibit plasticity, i. e. plastic flow, consist of a mixture of two materials, one of which is dispersed in a continuous phase in the form of particles having decidedly larger dimensions in one direction than another, such as for example, rods or thin plates. As these rods or plates become aggregated and oriented in the material, they will determine the particular mechanical properties of the same.

Nomenclature

For the sake of simplicity, in considering the resinoid materials that will be described now, we have decided to adopt the nomenclature suggested by O. Gamber, and will term the phenol-aldehyde condensation products "Phenoplastics". In strict analogy, we shall term the condensation products primarily based on urea as "Aminoplastics," although we are well aware that there are a large number of synthetic resinoid substances that would fall outside of these two main classes. While the constitution of the phenol-aldehyde condensation products has been fairly well established, much remains to be done to determine the nature and structure of the urea-formaldehyde and analogous plastics.

However, in the formation of both the phenoplastics as well as the aminoplastics, the reaction takes place in the presence of electrolytes as contact agents or catalysts. These have almost always been spoken of as condensing agents, although it now appears more probable that they are in reality only agencies that promote polymerization. It seems reasonable to assume that the first effect is the formation of a comparatively simple condensation product or relatively low molecular weight, which then, by one uniting with other molecules of the same kind, and without any change in the structure of the simpler molecules, builds up aggregates that eventually reach a size that gives rise to a colloidal condition. The far-reaching investigations on shellac, made by Harries and Nagel[1], and the work of Pollak and Ripper[2] on the formation of the urea-formaldehyde condensation products, which for the first time took into consideration the colloid viewpoint in this field, and led to the first technically valuable products among the amino-plastics, bear out these assumptions[3].

The course taken by the polymerization of resinoid materials, or, more strictly speaking, the aggregation of the smaller molecules[4], in the case of the pheno-

(Continued on page 320)

1. Harries and Nagel, Scientific Communications of the Siemens-Konzern, 1923, 3, 253 and 248. See also Stäger, "Die Kolloidchemie der Isoliermaterialien in Kolloidchemische Technologie," published in 1926 by R. E. Liesegang (Th. Steinkopff, Dresden).
2. F. Pollak and K. Ripper, Chemiker Zeitung, 1924, 48, 569, 589.
3. See page 320.
4. See page 320.

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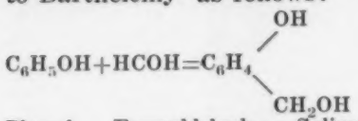
Mechanical Properties of Plastics

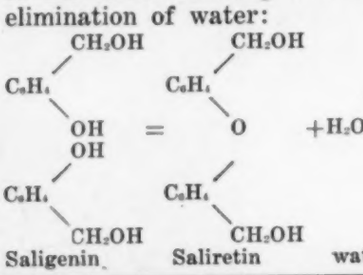
(*Continued from page 318*)

plastics takes the form of three distinct and separate stages, which Baekeland has termed the A, B and C stages. The simplest reaction between phenol and formaldehyde, is, according to Barthelemy[5] as follows:



Phenol Formaldehyde Saligenin

The product, saligenin, then forms saliretin, two molecules of the former uniting with the elimination of water:



Saligenin Saliretin water

The simple saliretin molecules now react with each other, with still further elimination of water, to form complexes having higher molecular weights, finally reaching such molecular dimensions that a viscous oily liquid results. This liquid is still soluble in alcohol and in alkaline solutions, but on standing, while warm, gradually becomes more viscous and finally gelatinizes.

As long as the product is soluble, it is said to be in the A stage. Further heating then leads to more aggregation and the mass finally becomes difficultly soluble, or even reaches a stage in which it merely intumesces or swells when brought into contact with a solvent such as alcohol. This constitutes the B stage, but it is difficult to state exactly where the transition from A to B takes place. However, while in the B stage, the material is always still soft when warm.

Aggregation

As the aggregation continues to proceed the colloidal plastic properties becomes more sharply apparent, until finally the C stage is reached. In this condition the material is no longer plastic, nor is it soluble in the usual solvents. This body is the one usually spoken of as the phenoplastic.

In the case of the aminoplastics, the reaction takes a different course. Pollak and Ripper were the first to work out a technically practical method for the formation of these substances. In the case of the aminoplastics the transition of the initial reaction product into continually more viscous masses does not occur, but the reaction is divided sharply into two entirely distinct phases, the first of which comprises merely condensation, and the second merely aggregation. The condensation stage will take place in the absence of free acid, but the aggregation is favored and takes place only in the presence of hydrogen ions. It is somewhat remarkable, but the polymerization can also be influenced by neutral salts. By buffering and controlling the hydrogen ion concentration it becomes possible to convert one phase into the other under definite and accurate control and hence makes it possible to produce, at will, materials having definite and predetermined properties and degrees of dispersity.

Together with the work of Harries in the case of shellac, and the results of the researches on the resins, it becomes evident that there is a very definite relation, in the case of the synthetic resins, between the properties and the degree of dispersion[6], and that such relationships as the assumption of resinogenic and resinophore groups—in analogy with the chromogenic and chromophore groups in the case of the organic dyes—are probably purely hypothetical, although some workers hold the opposite view[7].

In order to lead to materials having plastic properties it is essential that the aggregation takes some course that yields fibrous or lamellar particles, as contrasted with the formation or mere lumps. The necessity for the formation of particles having pronouncedly larger dimensions in one direction is very marked.[8] Furthermore, it

(*Continued on page 327*)

3. C. Ellis, U. S. P. 1482357 (1922). Also Lüdy, Monatshefte f. Chemie, 10, 295. F. v. Hemmelmeyer, Monatshefte f. Chemie, 12, 90. C. Goldschmidt, Berichte, 29, 2438. Einhorn and Hamburger, Liebig's Annalen d. Chemie, 361, 132, 139. (The preceding have studied the condensation products of urea with the aldehydes. The basis for the preparation of technical aminoplastics was laid by H. John (Austrian Patent 78251, see also the corresponding U. S. Patent in PLASTICS, 1928, 3, 214), and later improvements on the process by H. Goldschmidt and O. Neuss, which, however, did not lead to technically valuable products. Pollak and Ripper finally succeeded in producing a valuable material under the name of POLLOPAS. This material has been patented, Austrian Patents 98545, 99415, 99906, 101293, 103910. Soon after the Badische Anilin u. Sodafabrik patented products said to be suitable as substitutes for quartz glass (German Patent 416753). For the most recent products in this field see Barry-Drummond Morrell, "The Natural and Synthetic Resins, London 1926, p. 171, and the Indexes to PLASTICS for 1925 to 1927.

4. The term "Aggregation" is to be preferred to the older term "Polymerization", as in the case of resins the size of the particles will vary within very wide limits, and the term "polymerization" had better be confined to such combinations in which several equally sized molecules unite in equal numbers to form a definite larger molecular grouping.

5. H. Barthelemy, Revue des Produits Chmiques, 1925, 28, 361.

6. A particularly interesting example of this type, recently disclosed, is the synthesis of chlorophyl by Willstätter. The synthetic chlorophyl only began to exhibit the characteristic properties of the natural chlorophyl, namely its ability to bind CO_2, after the synthetic chlorophyl had been brought to a colloidal state of dispersion.

7. For the opposite view see W. Herzog, Chemiker Zeitung, 1925, 49, 119.

8. See earlier articles in the present series. Also G. Keppeler, Keram. Rundschau, 35, 157, who demonstrated that in the case of clays the size of the grain alone was not a determining factor in their plasticity, but that the shape of the particles was important.

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TECHNICAL ABSTRACTS
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Container Molded from Resinoid Materials. British Patent 265566, Feb. 2, 1926. Säureschutz Gesellschaft, and J. Wirth.

The manufacture of containers from moldable resinoids is described, the patent covering the mechanical details of the operations mainly.

Modern Solvents and Plasticizers of the Cellulose Ester Plastics. August Noll. In Farben-Zeitung, 1927, 32, pp. 1553-1555. Also in Chemiker Zeitung, 1927, 51, 546 and 566. (German).

This is a condensed list of the chemical composition and trade name of the modern cellulose ester plasticizers and high-boilers and solvents. The more important chemical properties of the materials is given. (This article will appear more extensively later). (See also C. P. van Hoeck, Farben Zeitung, 1927, 32, 1737).

A Review of the Artificial Resins. A. Gerard, in Journal de Pharmacie et de Chimie, 1927, 6, pp. 110 and 159. (French).

This is a complete and extensive review of the resinoids in modern use, including the phenoplastics, acrolein resins, furfural resins, cumarone resins, aminoplastics, including their discovery, history, properties, uses and tests. The article concludes with a bibliography covering the subject in its broader phases.

New Source of Plastics; Condensation products of acetylene with fatty acids. British Patent 265677, Nov. 9, 1925. L. Bourgoin.

Plastic products suitable for the manufacture of insulating materials, hard rubber substitutes and the like may be prepared by treating fatty substances, either of animal or vegetable origin (or mixtures of free fatty acids with glycerol) with steam under pressure in the presence of calcium carbide, so that acetylene is produced. Under such conditions the acetylene will combine with the fatty materials producing materials analogous in behavior to some of the resinoids. The reaction requires about 5 hours, and the temperatures given in the examples varies from 100 to 350°C.

Aminoplastics. British Patent 266752, Feb. 27, 1926. Interessen Gemeinschaft Farbenindustrie. (German Dye Trust).

Urea, thiourea and the like condensation products with formaldehyde and analogous compounds are prepared, using acid catalysts. By neutralizing the catalysts before high molecular weight products are formed, the properties of the products can be modified.

Aminoplastics from urea and thiourea. British Patent 266028, Nov. 5, 1925. British Cyanides, Ltd., and E. Rossiter.

Resinoids or aminoplastics are prepared from a mixture of urea and thiourea which is condensed with formaldehyde. Alternatively, the urea and thiourea may each be separately condensed with the formaldehyde to the preliminary water-soluble stage, and the solutions then mixed and treated further.

British Patents

Starting with the present issue. PLASTICS *will bring to its readers in this section, a review also of the British Patents.*

The interest of our many readers in the British Isles in our periodical has caused us to take this step. Furthermore, we also feel that many of our American readers will be interested to follow the progress made in the plastic materials in England.

The dates following the British Patents are the dates of application and not the date of issuance, as contrasted to the American system where the patent is dated from its issue.

Testing Electrical Insulation at High Frequencies. J. L. Rylander, in Electric Journal, 1928, 25, 10-13.

A description of a test of insulating material that is claimed to give positive and definite information as regards the insulating power of the material.

Electrical Insulating Material. British Patent 266370, Feb. 18, 1926. A. Mouillefarine.

Consists of formed pieces of wood from which the moisture has been completely removed, and which has been thoroly impregnated with melt-earth wax (ozokerite). The material is deep black and appears like hard rubber. It is not thermoplastic.

Aminoplastic. British Patent 266389, Oct. 1, 1924. F. Pollak.

Pulverized condensation products of urea and formaldehyde are transformed into homogeneous bodies by treatment with solvents or by the use of the initial condensation products of urea and formaldehyde.

Pyroxylin from Sulfite Tissue Paper. K. Atsuki and M. Ishihara, in Cellulose Industry (Tokio, Japan), 1926, 2, 175.

On the basis of exhaustive tests made by these investigators it appears that there is no real reason why a well made sulfite tissue can not be used for making high grade pyroxylin suitable for the manufacture of plastics. The sulfite paper contained 92.7% of alpha-cellulose as compared with 98.8% in the cotton paper. When nitrated under identical conditions, the viscosities of the pyroxylin obtained, when dissolved in ether-alcohol mixtures was 41.2 for the sulfite paper and 52.0 for the cotton paper. Actual cotton when nitrated yielded a product having a viscosity as high as 609. The relative tenacity of films (containing camphor) made from the pyroxylins were: with sulfite paper as a base, 4.72 kg. per sq. cm.; cotton tissue 6.18; and cotton 8.24. The low yields complained of in industrial applications of sulfite tissue when nitrated may be overcome by improvements in the paper and advanced nitrating technique.

Cellulose Esters of Higher Fatty Acids. Ichiro Sakurada and Tadishi Nakashima, in Scientific Papers of the Institute for Phys. and Chem. Research, Tokio, Japan. 1927, 6, pp. 153, 165, 197 to 213.

A scientific study of the esters of cellulose with the higher fatty acids such as the stearate, palmaite and the like. Also includes a study of the solubility of cellulose acetate in acetone.

Molding Composition of Cellulose Compounds and Proteins. British Patent 248781, March 6, 1926; and 266660, March 1, 1926.

The first patent covers a composition made by mixing pyroxylin 60 parts, kneaded with a mixture of ethylene chlorihydrin and water, and 40 parts of casein similarly treated. The mass, which may also contain inert coloring matter and fillers, is then hardened with formaldehyde producing a mixed casein and pyroxylin plastic. The second patent extends the idea to albuminous substances such as waste horn in lieu of the casein.

Resinoids (Synthetic resins) and their Applications. A. Breguet, in Revue generale des colloides, 1927, 5, 681-690. (French).

This is another concise resume of the origin, manufacture, properties and applications of the phenolic resins and analogous materials.

Modifying the Properties of Cellulose Acetate. British Patent 267569, March 15, 1926. H. Pringsheim.

Cellulose acetate may be depolymerized without the usual hydrolysis by heating the material in non-solvents such as tetralin. The optimum temperature is 208°C. The solubility of the cellulose acetate is considerable improved and the viscosity is markedly lowered.

Cellulose Esters Manufacture. British Patent 268289, March 24, 1926. Interessen Gemeinschaft Farbenindustrie (German Dye Trust).

The cellulose intended for esterification is pretreated with organic acids such as lactic acid. (See also British Patent 263128 where formic and acetic acids are used for the same purpose).

Cellulose Ester Compositions. Canadian Patent 275323, Nov. 8, 1927. H. J. Hands.

Carbohydrate esters, such as cellulose or starch esters are worked up into plastics together with trichlorinated propane derivatives as plasticizers.

Resinoid Coating Compounds. British Patent 267736, April 27, 1926. The Bakelite Corporation.

A condensation product of phenol (or cresol) with a vegetable oil such as China wood oil, condensed in presence of a catalyst such as phosphoric acid, is dissolved in a solvent together with an agent for hardening the material on heating.

Thermoplastic or Thermo-set Casein Compounds. British Patent 268804, March 31, 1926. Interessen Gemeinschaft Farbenindustrie, (German Dye Trust).

Casein solids or similar albumenoid plastics are mixed with substances that give off formaldehyde on heating, so that molding powders, suitable for hot pressing, can be produced. The materials specified are methylol ureas and methylol urethanes.

Phenolic Resinoids. British Patent 269037, Aug. 12, 1926. G. and N. Hick.

Concerns the hardening of phenoplastics, such as dentures and the like, by placing them in a sealed container together with a gas under pressure, or a volatile liquid, and applying heat to the receptace. The pressure engendered insures the even hardening of the material.

Solubility of Cellulose Compounds. W. von Neuenstein, in Kolloid Zietschrift, 1927, 41, 183.

Discusses the colloid-chemical relationships of the solutions of the various cellulose esters and ethers. Ostwald's "peptization rule" is stated to apply also to dispersions of cellulose acetate in chloroform and in ethyl acetate; and for pyroxylin in mixtures of alcohol, benzene and acetone, the amount dissolved depending (and increasing) with the amount of colloid (pyroxylin) originally present.

Cellulose Acetate. British Patent 269012, June 21, 1926. Courtaulds, Ltd. and C. Diamond.

Cellulose, in the form of wood pulp or cotton, and especially such as has had a treatment with alkalies that renders it difficult to acetylize, is treated with a phenol, such as phenol, cresol or meta-cresol. The action takes place at around 50 to 60°C, but can be carried out at room temperature, the cellulose being agitated with the molten phenols. The latter are removed before the material is esterified.

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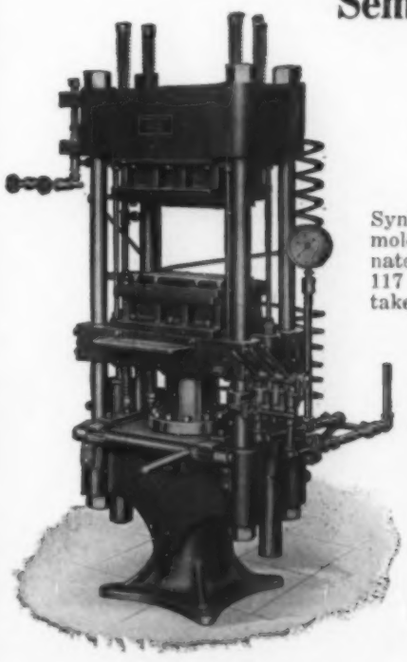

Semi-Automatic Molding Press

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Synthetic Resins and other Plastics, molded in Dies, or in Flat or laminated Sheets. Four sizes, 75, 96, 117 and 168 tons pressure. Will take molds up to 18"x26" for the larger size. Adjustable ejector bars on both head and platen; and quick drop attachment for lower ejectors. Pull-back Cylinders, Copper Coil Steam Fittings, Operating Valves and Pressure Gauge. Also Plain Hot and Chilling Presses, Accumulators, Pumps, etc.

Presses for Special Work made to order.

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Established 1872.

Dunning & Boschert Press Company, Inc.
No. 330 West Water St. **SYRACUSE, N. Y.**

Experimental Ornithopter Employs Celluloid Wings

Inventor who has been before the public eye quite a bit of late, uses cellulose sheets for new type planes wings

A MAN-MADE "bird" with celluloid wings measuring 29 1-2 feet from tip to tip has been made. If the hopes of George R. White, the builder, are realized, the mechanical bird will take to the air, lifting White's weight of 160 pounds in addition to its own 118 pounds.

White has worked for six years to produce a successful ornithopter, and he believes his theories are at last very near to realization. In a smaller and cruder machine, White is said to have flown eight-tenths of a mile at Cocoa Beach, Fla., last summer.

White's feet and the ornithopter's rubber "muscles" will provide the motive power for the strange-looking mechanism. The framework of the ornithopter is of chrome molybdenum. The wings are constructed of a patented variety of celluloid, with high tensile strength. The body is covered with the same material.

The wings have a maximum up-and-down beat of 17 feet. The "feathers" spread on the upward movement and contract as the wings sweep downward.

For the upward beat, the wings are actuated by heavy rubber cables. These were devised by White as substitutes for a bird's muscles.

White hails from Stony Brook, Long Island. He is a former army flying instructor and technology student. Hamilton M. Wright, Jr., youthful New York Newspaper writer, is assisting him in preparations for his flight attempt, which is to be made under the auspices of the Junior Chamber of Commerce at St. Augustine.

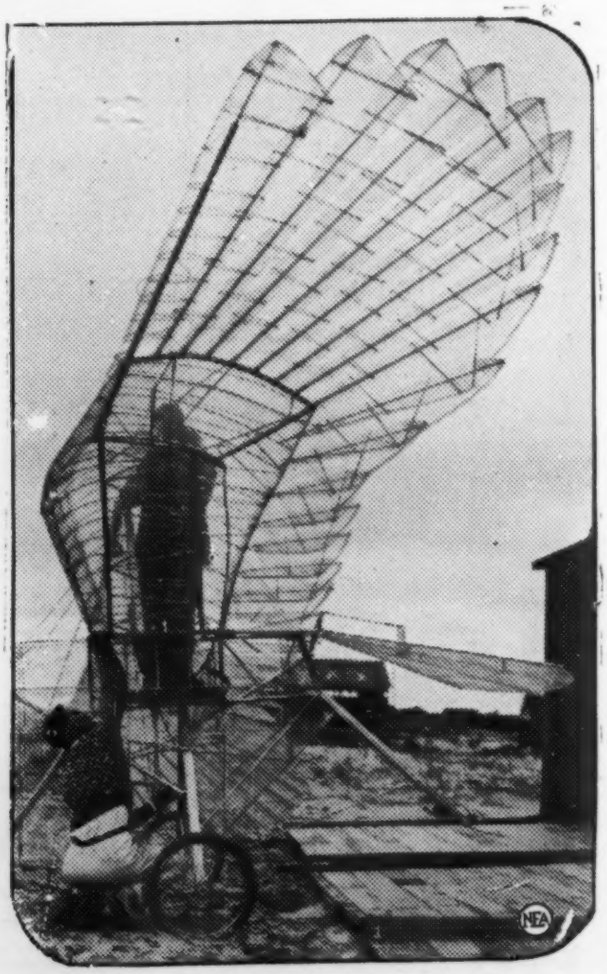
Aviation experts already have credited White with more progress toward approximation of the flight of birds than any other student of ornithopter construction. White's studies date back 400 years to the research of Leonardo da Vinci.

At Cocoa Beach last summer, White had seven crashes. The last one knocked him unconscious. But he wasn't deterred.

"I admit it is the part of wisdom to perfect and improve methods of flight already established," he said. "At the same time, there would be little progress if men were not willing to venture into new fields.

"No one has proved that man cannot imitate bird flight. I am confident it is possible."

Birds gain forward momentum from the upward strokes of their wings, White believes. On this theory, he has not sought purely vertical motion for the wings of his ornithopter. A slanting upward movement decreases resistance and at the same time provides a forward thrust, he holds.



Side view of ornithopter showing transparent wings. Through courtesy of The Nea Service.

Properties of Celoron

GRADUALLY the line of resinoid molding materials is increasing, and many of the concerns that were formerly buying their molding powders, or making their own for personal consumption, are now offering tried and proved products to the general public. From time to time, we will publish informative articles giving the essential features of the new products, so that our readers may be kept aware of the developments. It is our belief that the publication of such data, when based on actual tests, and when it is not mere advertising copy, has a distinct value.

Among the materials offered during 1927, there is a phenolic condensation product known as CELORON, which is the product of a company bearing that name, and which is a division of the Diamond State Fibre Co , of Bridgeport, Penn.

Following is a tabulation of the physical and electrical qualities of Celoron molding powders:

	Type "S"	Type "M"
Compressive Strength	25,000 lbs	30,400 lbs.
Tensile Strength	5,080 lbs.	8,430 lbs.
Dielectric Strength (Volts per mil)	484	392
Dielectric Constant	367	447
Surface Resistivity, Megohms	10,150	40,000
Water Absorption (24 hrs.)	.94%	.57%
Specific Gravity	1.362	1.375
Power Factor	3.82	3.84
Resistance to 2% Alkali	Fair	Good
Resistance to 2% Acid	Good	Good
Shrinkage, pulled hot per inch	.0069"	.0066"
Cooled, per inch	.0044"	.0034"

The Diamond State Fibre Company has long been known for its development in the field

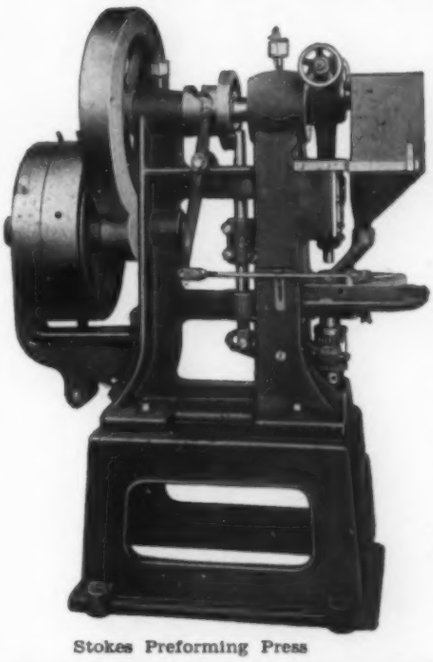
(*Continued on page 329*)

FJS

Preforming Presses

for

Durez and Bakelite



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STOKES "T" and "R" Presses make

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Your finishing costs can be materially reduced by this revolutionary method of tumbling your parts.

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Fusing The "Infusible" Resins

(*Continued from page 310*)

ed infusible resin made from m-cresol in presence of hydrochloric acid or finely powdered non-fusible resin made by heating fusible cresol resin with trioxymethylene can be rendered fusible by heating with colophony or cumarone resin or by digesting in autoclave with palm resin (gutta percha). Or infusible resin obtained by condensing crude cresol without catalyst can be made fusible by action of colophony, ammonium chloride and heat. The infusible resin obtained by heating o-, m- and p-cresoldialcohols can be rendered fusible by means of colophony, while if colophony is added to the fusible resins, they will not become infusible on heating. The resins after being rendered fusible can be dissolved to clear varnishes in boiling linseed oil or mixtures of alcohol and benzol.

As Stated By the Inventor

"The great importance of the hereinbefore disclosed invention is, briefly stated, thus:

Firstly the new method affords the possibility of again converting the large quantities of non-fusible resins, forming the scrap from the mechanical working of non-fusible resins, or obtained as defective or worn articles, in a most simple and economic manner into soluble and fusible substances.

"A special advantage of the new method consists in its allowing of removing from articles which, to a certain degree will withstand heat, coatings consisting of non-fusible resins and which have become defective and unserviceable, so that not only these non-fusible resin materials but also the articles coated therewith may be utilized anew. So, for example, metallic wires coated for the purpose of insulation with non-fusible resins may be treated in this way.

"Furthermore, the new method, also allows of always converting partly or completely non-fusible resin, which has unintendedly been formed in the condensation process, into utilizable fusible resin.

"Neither phenols nor mixtures of phenols can be condensed with formaldehyde alone, with or without contact means, in quantitative proportion to completely fusible and soluble resins. According to the character of the phenol of the mixture of phenols, respectively, and the manner of performing the condensation process it was in this case till now necessary to work with a more or less great surplus of phenol in order to avoid the formation of partly non-fusible products.

"With crude cresols, containing about 40% m-cresol, only 2/3 of the cresol employed may be converted by condensation without addition of contact means, into fusible resin. If however, before or during the condensation sufficient quantities of a fusible articial or natural resin are added to the reaction masses, it will be possible to convert in one operation all the phenol into fusible resin. If, nevertheless, a conversion into non-fusible resin should occur, it will only be necessary to highly heat the material further with very small quantities of natural or fusible artificial resins, in order to obtain the desired fusible resin."

Baekeland's Opinion

It has been previously stated that the Bakelite resins in their final state are insoluble and infusible. In this connection it is interesting to note that Dr. Baekeland, the inventor of theso resins, is of the opinion that there is no such thing as an insoluble substance. Testifying in the recent Brunswick-Balke-Collendar infringement suit, that noted inventor stated that a substance is said to be insoluble if, when it is put into a designated solvent, it does not dissolve therein so as to produce a substantially homogenous mass in which there are no lumps, though it may swell in that solvent. He went on to say that Bakelite C may be 99%, sometimes 60%, insoluble and still be the so-called insoluble, infusible Bakelite of his patents. However that may be, the fact remains that these resins are generally considered to be insoluble and much effort has been expended in finding possible solvents.

Lenher's Work

The only worker who seems to have successfully accomplished this without first converting the final product back into the intermediate fusible product is the late Dr. Victor Lenher of Wisconsin. This learned scholar and research worker has contributed six patents on the manufacture and use of selenium oxychloride to the rapidly growing patent literature. In these patents, particularly Patent No. 1,445,329 dated February 13, 1923, it is stated that selenium oxychloride, especially when it is compounded with sulphur trioxide is a solvent for many hitherto insoluble substances including the final condensation products of the Bakelite type. Several claims in this patent broadly cover a method of effecting a solution of a carbon compound or a resinous substance and a method of removing coatings, varnish, paint or the like.

LATE!

A fire in the establishment where PLASTICS *is printed occuring just after the pages were ready, has delayed the appearance of the present issue.*

We hope our readers will pardon the delay.

Properties of the Resinoid Plastics

(*Continued from page 320*)

is advantageous, and leads to more elastic products, if these particles can be caused to orient themselves and, still better, if they will unite in some way to form long chains or surfaces. This tendency can be enhanced by subjecting the material, while it is undergoing the aggregation, to motion, either lineal or rotary, in one direction.

Several authors have recognized this fact and have pointed out the advantages of continuous stirring during the preparation of synthetic resins[9]. A detailed quantitative research on this point has recently been carried out by Freundlich and Kroch[10], using a practically electrolyte-free copper oxide sol (having a specific conductivity of around 3.10^{-6}) and likewise with a similar ferric oxide sol. They have shown that by merely mechanically stirring these sols that, in certain cases, coagulation was effected merely by the orientation of the collodial particles.

9. Cf. S. P. Schotz, "Synthetic Organic Compounds", Ernest Benn Ltd., 1925, p. 343. Also C. Ellis, "Synthetic Resins and their Plastics", 1923; Barry-Drummond-Morell, already cited, and Van Voorhout, U. S. P. 1271393.

10. H. Freundlich and H. Kroch, Naturwissensch. 1926, **14**, 1206 and Zeitsch. f. physikalische Chemie, 1926, **124**, 155; as well as the comment of Wo. Ostwald, Kolloid-Zeitschrift, 1927, **41**, 71.

This article will be continued in the July issue, when the elasticity and strength of various phenoplastics and aminoplastics will be discussed in the light of these theories and disclosures.

Plastic Industry in Austria

See JULY Issue

Your Pyroxylin Scrap is not

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HYDRAULIC PRESSES
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STEEL PLATENS
make the best products

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We Have a Press Exactly Suited To Your Work

HYDRAULIC PUMPS
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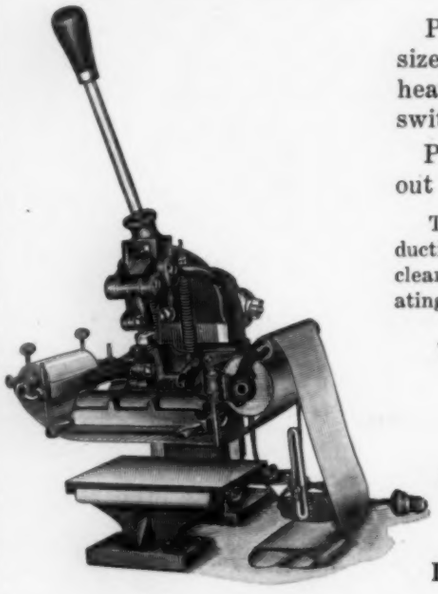
Our Gold Inlaying Press

WITH AUTOMATIC ROLL FEED

is just what you have been looking for. Will take Roll Leaf any width to 5". Positive feed from ¼" to 5½". Set ups and adjustments quickly made.



Press is made in three sizes furnished complete with heating units and 3-way switch control.

Presses sold with or without roll feed.

This Press will speed up production. The stroke gives ample clearance to feed in work eliminating the draw plate operation.

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75 Water Street
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Nitro-Cellulose for Lacquer and Artificial Leather

A New Service of Immeasurable Value

We will now buy back scrap Pyroxylin from our customers completing the circle of service from the new sheet to the scrap.

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LEOMINSTER, MASS.

Nixonoid in Sheets, Rods and Tubes

Super Pearl Essence in Lacquer, Amyl Acetate or Solution Ready to Apply

New England Representative For
NIXON NITRATION WORKS
HUDSON PEARL CO.

PEARL ESSENCE LACQUER COTTON

Patterns in Molded Cellulose Ester Plastics

(*Continued from page 311*)

article on the coalescing of the fabric with the material in the molding operation.

A fabric woven, knitted or otherwise formed from threads of filaments of fibres of cellulose acetate or other cellulose derivatives already containing the plasticizing agent or agents, may be used. A fabric of cellulose acetate or other cellulose derivatives may be soaked in a solution comprising any known or suitable plasticizing agent, of cellulose acetate, dissolved in a solvent which is non-solvent for the fabric.

How It Is Done

Example: A fabric woven, knitted or otherwise formed from cellulose acetate artificial silk, is soaked in a solution comprising a plasticizing agent dissolved in a substance which is non-solvent towards cellulose acetate, for example a solution comprising 60 parts benzol and 40 parts of a plasticizing agent such as monoalkyl derivative of an aromatic sulphonamide, for instance a xylene monomethyl sulphonamide. The fabric is then dried and the desired design or pattern applied for instance by printing from blocks with solutions of dyes in volatile solvents containing a plasticizing agent. The printed fabric is then dried and cut to desired shape, and inserted in the mold box between layers of molding powder consisting of or compriing cellulose acetate and a plasticizing agent, preferably the same plasticizing agent as that used in the solution for soaking the fabric, the molding powder being preferably employed in a state of fine division.

Any desired number of pieces or layers of fabric may be employed in any required relative positions according to the type

of article and effect it is desired to produce. The whole is then subjected to the necessary application of heat and pressure, for example in a heated hydraulic press, to give a homogeneous product containing the desired pattern.

Naturally when a plurality of pieces of fabric are employed they will be inserted in appropriate relation to one another to produce the desired pattern or effect, though it is of course understood that the individual pieces of fabric may or may not bear the same design or pattern, the design or pattern of the completed pressed article being produced from similarly or dissimiliarly printed or colored pieces of fabric placed in any desired relation or register each to the other or others.

The term "effect materials" used hereinafter in the claims is to be understood as including patterned or effect materials, sheets, slabs, blocks, or other articles or objects, while the term "substitution derivative of cellulose" is employed as signifying cellulose acetate, nitrocellulose, or methyl, ethyl or benzyl cellulose or other esters or ethers of cellulose.

Celoron

(*Continued from page 325*)

of impregnated fabric gears and panels. Their advent into the manufacture of molding powders for the general trade is more recent.

Every precaution is taken, and every mechanical means are provided to insure a uniform molding material which will overcome and eliminate one of the real worries of the molder. Close co-operation is maintained with, and a real service rendered by the Celoron laboratory staff. The complete and up-to-date apparatus of this laboratory is at the disposal of the molders in solving their problems.

These Celoron Molding Powders are also adaptable, and are being rapidly introduced, for

A Better Swing Joint For Your Molding Presses

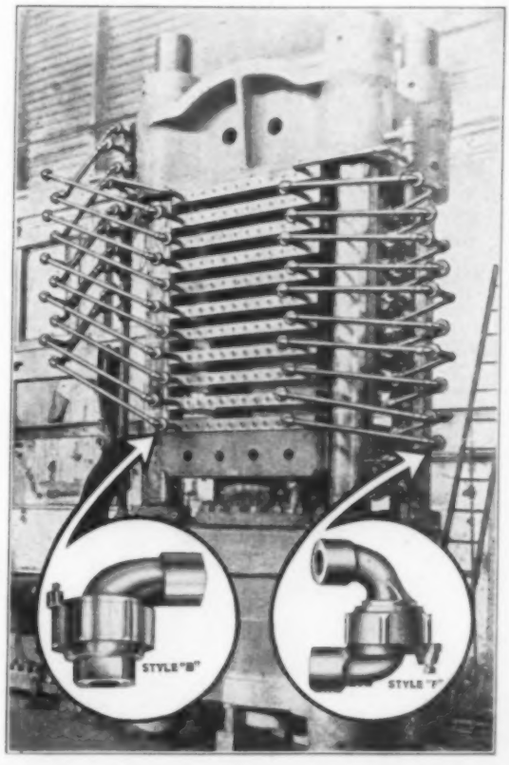
A movable steam connection is an important requisite on all types of molding presses.

FLEXO JOINTS will give you maximum service at a low—extremely low maintenance cost. Made of steam brass for durability they will outlast the pipe or machine to which attached. No packing is required. There are no springs to break or ground surfaces to wear. These joints are as simple as they are efficient. Just a four-piece design of extra heavy steam brass that will appeal to any practical man.

Made in all standard pipe sizes from ¼ inch to 3 inches.

FLEXO JOINTS are easily and quickly installed—smooth working, no chattering or binding.

Tell us the pipe size you use and we will send you a set to try—no obligation.



Any size or type of molding or vulcanizing press can be equipped with money-saving FLEXO JOINTS—none too large nor too small. Above is a photo of one of the largest, requiring 60—1¼ inch FLEXO JOINTS.

Style "A"

Style "B"

Style "F"

Style "H"

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Essential Books

Plastics and Molded Electrical Insulation.

Emile Hemming. 313 pages. Illustrated. $6.00.

Very special care has been taken in the preparation of the chapter on molded insulation. Contains hundreds of references to plastic and composition products and their utilization in industry.

* *

Casein and Its Industrial Applications.

Edwin Sutermeister. 296 pp. Price $5.00. Illustrated. 1927.

Eleven authorities, many of them specialists in this field, have contributed to this volume. "Casein Plastics" is from the pen of Dr. Geo. H. Brother.

* *

The Chemistry of the Natural and Synthetic Resins.

T. Hedley Barry, Alan A. Drummond and R. S. Morrell. 196 pp. Price $5.50. 1926.

The work of three English chemists, who are recognized authorities on this subject, one of vital interest to the Plastics Industries.

Celluloid.

Its raw material, manufacture, properties and uses.

Dr. Fr. Bockmann. 188 pages. 69 illustrations. $3.50.

In this book, the raw product, cellulose and its properties are thoroughly described. Other raw materials and methods of rendering them more plastic also receive attention.

* *

Synthetic Resins and their Plastics.

Carleton Ellis. 514 pages, illustrated. $8.00.

The book will serve as a guide and prove a stimulus to the numerous investigators and practitioners in the field of artificial resins. The section on plastic molding is an especially valuable feature.

* *

Pyroxylin Enamels and Lacquers.

Samuel P. Wilson. 213 pages. Illustrated. $3.50.

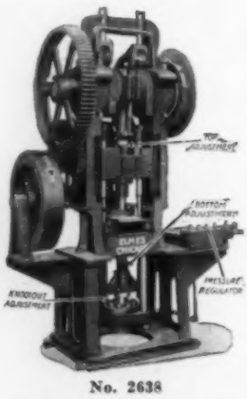
An authoritative work dealing with the materials and manufacture of pyroxylin solutions and with their application in the industry.

Write Book Dept. PLASTICS, 471 4th Ave., N. Y.

Special Purpose Presses

This automatic tablet machine is designed for producing tablets from powdered materials. It is provided with a special form of pressure regulator, which is adjustable to suit product and accommodate a variety of sizes in tablets.

Due to its application of pressure on both top and bottom of materials, uniform density is assured in large preforms. Power is transmitted to pressure elements by means of machine cut gears and crank shaft. Press can be stopped at any position.



No. 2638

Automatic Tablet Machine for larger Sizes of Preforms From Powdered Materials.

No. 2693

Patented Fool-Proof Control

No. 2693—The only design of press where the knockouts moving the press ram, or manipulating the valves. This patent feature permits reseating knockouts and die buttons without loss of time, and a maximum clearance for cleaning and refilling dies, giving 10% to 20% greater output.

E-HYDRAULIC-ELMES PRESSES & PUMPS SINCE 1851

Charles F. Elmes Engineering Works, 1002 Fulton St., Chicago, U.S.A.

the molding of small articles, smokers' articles, and equipment where very handsome and elaborate designs and colors are demanded, such as in picture frames and general interior decorating equipment.

About fifty modern automobiles are equipped with Celoron fabric gears for timing equipment.

World Trade! Netherlands

(*Continued from page 314*)

of horns. The bulk of these products is likewise imported in the finished state from foreign countries, such as Great Britain, Germany, United States, and France.

Promotion of American Trade

American plastics have not been imported into the Netherlands. American manufacturers who desire to enter this market must bear in mind that German and French manufacturers are now controlling this territory. The quality of German material is very good, both with respect to the plain and fancy product, and consequently competition will be very keen.

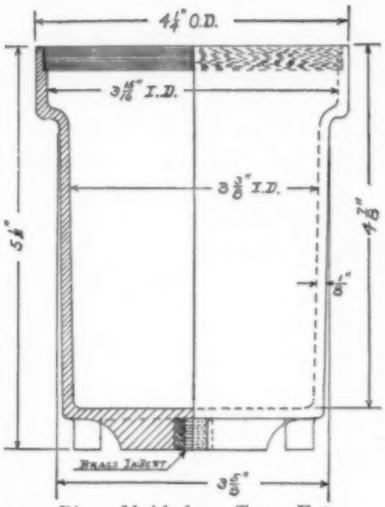
The best policy to be followed by American manufacturers of plastics is to appoint a local representative on a commission basis, and by so doing, keep their prices at the lowest possible level. In case an import merchant is employed as distributor there is the possibility of prices being fixed on a basis that would prohibit sales. A representative should be provided with sufficient stock to meet local demand.

A list of the Dutch fabricators of plastics and the firms dealing in plastics may be obtained by accredited firms upon application to the Bureau of Foreign and Domestic Commerce, Washington, D. C.

This Series will be Continued

Every Type of Molding Deep or Shallow

CAN BE DONE ON A TERKELSEN

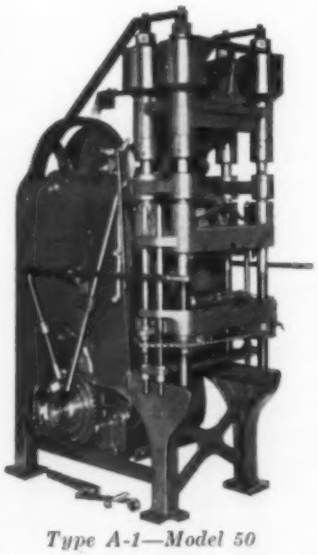


Piece Molded on Type E-1
Northern Industrial Chemical Co.

Working Area of Platens ..... 18½"x12½"
Maximum Adjustment of Upper Platen ..... 10"
Stroke, Standard ..... 12"
Motor ..... 3 H. P.
App. Weight ..... 4800 lbs.
Automatic Ejection

Type E-1—Model 50

No Accessory Equipment Required

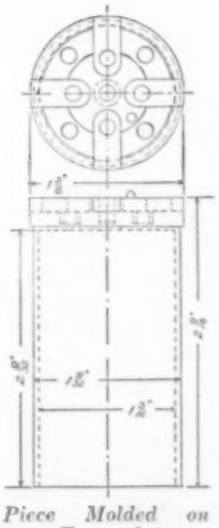


Type A-1—Model 50

Working Area of Platens ..... 18½"x12"
Maximum Adjustment of Lower Platen ..... 10"
Stroke ..... 5"
Motor ..... 1½ H. P.
Approximate Weight 4000 lbs.
Automatic Ejection

Different tonnages, stroke and platen areas available in either type.

Catalogue on Request.



Piece Molded on Type A-1
Pilot Electric Co.

TERKELSEN MACHINE CO.

330 A STREET BOSTON, MASS.

Cellulose Acetate

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ANNOUNCES THE OPENING OF HIS

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GRAYBAR BUILDING

420 LEXINGTON AVENUE, N. Y. C.

PHONE LEXINGTON 46.46

Patent History of Gears Made of Resinoids

(*Continued from page 313*)

19. Apple 1,390,242. Sept. 6, 1921.

The method of making laminated gears which consists in producing a series of circular disks of flexible absorbent material; slitting each disk near its periphery, into as many segments as there are to be teeth in the gear; placing between selected absorbent disks, metal disks having as many teeth as there are to be teeth in the finished gear, but of smaller dimensions; associating with said disks phenolic condensation product, to cause the same to adhere together; turning back upon itself a slitted part of each segment thus inclosing the metal teeth; compacting the assembled material in a die conforming in outline to the finished gear, by application of pressure; and heating the die and its contents.

20. Kempton 1,392,173. Sept. 27, 1921.

A composite article comprising a body portion of fibrous material, a wearing portion comprising a separate layer of fibrous material united to said body portion, said wearing portion only containing a lubricant and being held to said body portion by a hardened binder such as phenolic condensation product. Heretofore, in molding articles in which a lubricant, such as graphite, is utilized, it has been customary to distribute the graphite throughout the entire structure of the article to be molded. On account of the low adhesive properties of the graphite, this distribution tends to reduce the mechanical strength of the molded article. In view of this, one object of the invention is to mold composite articles, containing graphite as a lubricant, so that the graphite shall be localized in that portion of the molded article requiring the lubricant and to minimize, in this way, the weakening effect of the graphite.

21. Kempton 1,392,174. Sept. 27, 1921

A method of molding composite articles that comprises separately disposing substantially tubular bodies one of which is composed of superimposed layers of sheet material impregnated with a binder containing a lubricant and the other of which is composed of a comminuted material mixed with a binder in a substantially annular mold chamber, with one of the bodies surrounding the other, and applying axial pressure against them, together with heat, to compact the material and to harden the binder, whereby a unitary composite article is formed. This method makes the article in patent No. 1,392,-173.

22. McClain 1,401,622. Dec. 27, 1921

A self-sustaining gear comprising superimposed layers of duck impregnated with a hardened phenolic condensation product having a mixture of graphite and wax uniformly distributed therein. The amount of wax preferred is 1% of the binder employed. The wax also acts as an additional lubricant as well as insuring a smooth finished surface. A lubricant, such as soap-stone, or the like, may replace the graphite in the mixture which is applied to the sheet material after being drawn through a bath of an adhesive material. The amount of lubricant is usually 15% of the total weight of material in the product but this amount may be varied according to the degree of lubrication required.

23. Henninger 1,421,231. June 27, 1922

A method of making machine elements that comprises forming a hub portion with a plurality of continuous waved ribs on its periphery, impregnating fibrous material with a binder,

Accessories
For Toilet Articles

TASSI BROS. MIRRORS NEW YORK AND PARIS

Mirrors of the Better Kind for Fabricators of Celluloid Toiletware

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New York City

disposing layers of the material upon the hub and applying heat and pressure to compact the material and to harden the binder. Gear rings may also be formed by stamping or cutting segmental blanks from paper or fabric, coated or impregnated with a binder, such segments comprising, for example, one-fourth of a complete circle. The segments are assembled end to end to form a ring, and rings made in this manner are stacked one upon the other, the points at which the segments of each ring touch each other being staggered. When a suitable number of blanks have been stacked, one upon the other, in this manner, the pile is pressed and heated, thereby forming a ring in which the required gear teeth are cut.

24. Tupper 1,424,267. Aug. 1922

WOOD MOULDER—Wishes position as foreman or production manager. Long experience in large wood-moulding plant. Installation method, formulas. Age 33, married. Box 81. Address PLASTICS, 114 E. 32nd St., New York City.

Engineer, with sound chemical training, for many years connected with a molding plant, including manufacturing of Phenolic Resin and molding powder, desires position. Box 85.

WANTED

To buy a molding plant within a radius of twenty-five miles of New York, not less than 10,000 square feet and should be ready for immediate occupancy.

Box 61, PLASTICS, 114 E. 32nd Street, New York City.

CELLULOID FOR SALE

Discontinued lines in the form of sheets, rods and tubing of various sizes and colors. For further information, write

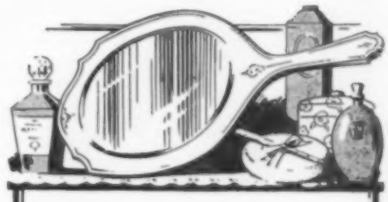
Shuron Standard Optical Co., Inc.
Rochester Division, Rochester, N.Y.

FOR SALE: Daylight factory in Manufacturing Community within 10 miles of Manhattan. Suitable for paints, oils, plastics, or any semi-hazardous industry. 10,000 sq. ft. manufacturing space, with 2,500 sq. ft. storage, boiler house and garage. Fire proof construction. 4½ acres land, 630 feet Railroad frontage. Excellent opportunity for small manufacturer. Price and terms from Box 75, Plastics, 114 E. 32nd St., New York City.

ENGINEER WANTED. With sound chemical training and experience in compounding and applying rubber mixture. Box No. 62, PLASTICS, 114 E. 32nd St., N. Y. C.

DEVELOPMENT AND PROCESS ENGINEER for phenolic molded compositions. Must have sound chemical and engineering training as well as several years of plant experience including at least one with the manufacture and molding of phenolic resin mixtures. Box No. 63, PLASTICS, 114 E. 32nd St., N. Y. C.

A method of forming a composite gear which comprises inserting a metal center in the matrix of a mold, disposing a plurality of folded strips of



Good Mirrors will guarantee approval of your Product

Standard Mirror Co
151 - 157 HARRISON STREET
Buffalo

fibrous sheet material impregnated with a phenolic condensation product around said center with the folded laminations disposed radial to the center, placing a pressure plate on the assembled structure and simul-pressure thereto to consolidate the mass.

25. Aiken 1,427,892. Sept. 5, 1922

A gear wheel comprising a metallic toothed rim having an inwardly projecting flange located centrally thereof, a metallic hub having an outwardly extending flange, rigid projections carried thereby, and a disc of non-metallic material preferably in the form of a phenolic condensation product such as Bakelite of substantially the same width as the rim and having the flange of the rim and the projections of the hub flange embedded therein.

PEARL
ESSENCE
Super Quality Pigment
in
Paste
Lacquer
or
Solvents

Our Chemical Department Specializes in Creating
The Finest Essence

STANDARDIZED

Samples forwarded on request.
Or
Send your Articles to us and our Chemical Dept. will produce the required finish and formulae for you.

Jos. H. Meyer Bros.
Manufacturers of Richelieu Pearls
220 Twenty-fifth St., Brooklyn, N. Y.
Display Offices
389 5th Ave., New York---804 Walnut St., Phila., Pa.

26. Guay 1,436,956. Nov. 28, 1922

A roll comprising a body of spinnable textile fibers, end plates for holding the fibers under compression and means for uniting the end plates, characterized by the fact that the body is thicker at the center than at the periphery and that the end plates are outwardly dished at their central portions and exert a greater compression pressure on the fibers located near the center of the body than on those near the periphery.

27. Taylor 1,438,875. Dec. 12, 1922

A material for use in the manufacture of mechanical elements consisting of a series of fabric layers bound together by a solidified phenolic condensation product and each consisting of interwoven cotton and metallic threads.

28. Bierman 1,440,440. Jan. 2, 1923

A method of forming composite articles which comprises providing a metal center cutting a strip of sheet material along one edge to form notches and along the other edge to form slits, winding said material with the edge having the notches adjacent to the face of said center to form superposed layers, and uniting said layers to form a unitary mass. A strip of fibrous material, such as paper, cloth, asbestos, or other suitable material, such as sheet cork, impregnated with a suitable binder, such as a fusible, soluble phenolic condensation product, is used in this process.

A further enumeration of the plastic gear patents will be found in the July issue.

History of The Comb!

Coming!

MOLDED PRODUCTS

Devoted to the purchase, further use and merchandising of all manner of molded parts

Vol. 2 JUNE, 1928 No. 6

Knowledge Every Buyer of Molded Products Should Have

A comprehensive digest of information essential to ordering molded products with a view of getting 100 cents value for every dollar spent.

By Leon V. Quigley

FIRST of all, the buyer should have some knowledge of the principal types of plastics which are classed as molding materials or "compositions". The term *molding materials* is preferable when describing the subject generally. As will be realized from the subsequent description, the term *composition* has come to refer to a particular type of plastic.

There are four principal kinds of molding materials:

(1) "Mold compositions" usually materials made with shellac, or shellac and rosin binder. This type of material is often referred to in the trade as "button stock".

(2) "Cold mold product", made with ground asbestos, bonded with stearine pitch, and subjected, after molding, to a long oven baking.

(3) Hard rubber, involving generally the rubber base plus a vulcanizing agent, notably sulphur. The term *hard rubber*, however, is a very elastic one, and is applied to products ranging from pure rubber plus sulphur, down to those which contain only about 10 per cent of rubber, with the balance contributed by cheap fillers.

(4) Phenol resins, of which Bakelite resin is the pioneer product. Among all classes of molding materials, the last named is undoubtedly the leader, having the greatest number of present uses and entering constantly an endless field of new applications.

Each type of material has its place in the plastic arts, and it is the business of buyers to know not only the merits but the limitations of each.

When test data indicating the properties of a given material are submitted, the purchasing agent should be informed of the conditions of test. In many cases test data are comparable only when various governing conditions, such as size of sample temperature, time, etc., are taken into account, Electrical engineers have long recognized the need for standard methods for testing molded insulation. It has been realized, moreover, that without agreement on methods no agreement in results can be expected.

Considering dielectric strength, for instance, a given figure of volts per mil has little significance unless the thickness of test sample and character of electrodes is defined. It has been stated that almost any value of dielectric strength may be obtained for a given material, depending upon the method employed in making the test. Dielectric strength is not proportional to sample thickness —with some materials it will vary as the square root, although this can by no means be accepted as a general rule. It would be entirely incorrect to assume that by doubling the thickness of a piece of insulation, its dielectric strength (volts per mil) would be correspondingly increased. On the

other hand, neither would its dielectric strength be proportionately reduced if the thickness of the insulation were cut one half.

Test Standards

Further, the significance of claims that a given material has certain electrical properties, will depend entirely upon the method employed, and the standards accepted with regard to thickness of piece, shape of electrodes, duration of test, etc. Not in the matter of dielectric strength, alone, but in other properties, such a insulation resistance, power factor, water absorption, hardness, etc., the conditions of test should always be ascertained.

To meet the need for scientifically established methods of testing that would be accepted generally by electrical engineers and manufacturers, the American Society for Testing materials some years ago, appointed a body known as Committee D-9. This Committee, which was composed of engineers from leading companies, users or manufacturers of electrical insulating materials, set to work to develop a series of standardized methods for testing.

As a result of the intelligent labors of Committee D-9, A. S. T. M. standards are today accepted generally in the electrical world. The purchasing agent will find of interest, the publication entitled "Standard Methods of Testing Molded Insulating Materials", issued by the American Society for Testing Materials, 1315 Spruce Street, Philadelphia, Pa.

The buyer should of course have a reasonably thorough knowledge of what the molding composition is to be used for; especially the most strenuous service it will be required to withstand. He should have this information so that he may be in position to advise fully with the supplier of the molding material, as to the purpose for which parts in question are to be used. For instance, it should be stated what, if any, chemical action the molded parts must be capable of resisting, also what temperatures, and what mechanical or electrical stresses they must bear.

Grades of Materials

It should be borne in mind that all manufacturers of molded products use many different grades of materials, each one of which is best for some particular use. It is of course, the business of the molder to make selection of the proper grade of molding materials, once he is in possession of full information as to the service requirements of the finished product.

First cost is not the only point to be considered. Qualities such as lightness in weight and lustrous finish may enhance the sales possibilities of the molded products: durability

(*Continued on page 340*)

Why Not?

The Editor puts forward this suggested use for pyroxylin plastic sheeting with the hope that it will develop into business for some of our readers.

THIS publication is run for the benefit of the entire plastic industry as a whole. Therefore, we believe it is our duty not only to make record of uses to which plastic materials are being put, but also to suggest new uses when the opportunity arises. In some of these suggested uses, there may be some drawback which does not appear on the surface. However, that can best be determined by trying to actually sell the material for the purpose.

One case in point is a new type of advertising sign that has recently been placed on the market. This sign seems for the moment at least to have been designed for use on auto trucks, although we have seen a few hanging outside stores. Another place they are in use is on the caps of the R. C. A. messenger boys.

This sign makes clever use of a mirror and a piece of colored glass, usually red. The mirror is partially enclosed and on a slight slant. The red glass on which the letters of the sign are actually placed sets in a horizontal position over the mirror.

The letters are blocked in on the red glass. The main body of the glass being painted black and the letters remaining red. Light coming down from above shines through the lettering and is reflected on the mirror. The mirror being partially enclosed and in semi darkness the red letters stand out like fire.

Now the question comes up, why hasn't this sign manufacturer used colored transparent pyroxylin sheeting instead of glass in this sign. In a thickness of say 30/1000 red transparent it would unquestionably be stiff enough on the signs we have seen. It would be much lighter in weight. And if a negative finish one side sheet were used would be much easier to apply paint to.

As stated before, there may be some reason why this material will not fill the bill. It is even possible that one or all of the various pyroxylin manufacturers have tried to sell this job. However, we merely make the suggestion for what it is worth.

We will be glad to hear from any of our readers regarding the above, either as to resulting sales, or why they could not sell.

Molded Products Used In Making Globe Atlas

Completely molded globe incorporating an entirely new idea in sectional puzzles for maps.

THERE seems to be absolutely unlimited possibilities to the use of molded products. Every month sees a new development along lines that are totally unexpected. Each of these new applications gives a further demonstration of the versatility of the industry, its ability to meet the requirements of the particular job at hand.

We have before us this month something new in the form of a globe atlas for the school room or home. The first globe was made some four hundred years ago. They have been made since then of all sorts of materials from wood to papier mache. This job is a completely molded globe.

The globe itself is molded in seven sections which all fit on a metal axis. The map proper is printed on paper, and cemented onto the globe in the regular manner.

Made In Sections

The unique part about this globe, however, is that it is made in sections which come apart and in each of the six sections is molded the outline of one of the continents. These continents are divided into several sections by separate molded pieces which interlock and fit in together to make a complete map.

There is a total of 45 molded pieces used to make the complete job. Seven of these are the sections which comprise the globe. The other 38 are the inserts which go to make up the various countries.

Small Pieces Tinted

This entire job makes a very interesting example of the varied uses to which molding materials can be put to meet extraordinary conditions. While it would be possible to make this globe from materials other than molding compounds, it would require quite a bit of extra machine work to do so. Each of these forty-five pieces are turned out of the mould complete. The only other work needed is the tinting showing each country in different colors on the small inserts, and the pasting on of the paper gores which comprise the outside of the globe. Thus molded products enables an article to be put on the market at a price within reach of the average pocketbook.

Practically Unbreakable

Outside of its value from the standpoint of production of these intricate parts in one operation molded products has another big advantage in this work. When it is born in mind that this article is designed mainly for the use of children, the fact that it is practically unbreakable is a big point in its favor.

From the standpoint of salability, this article looks as though it would prove a good item for the molder. It undoubtedly has educational value. Its value from this angle does not depend on dry lessons but rather from the fact that it is also a puzzle.

(*Continued to page 353*)

Did you ever see

The Geographic Educator assembled as a single unit.

IN association with the Geographic Educator Corp., Scranton has produced an exceptional piece of work.

An exact globe molded in seven perfectly fitted sections. Each section divided into many smaller pieces separately molded in varying colors representing every country of the earth.

Thirty-eight separate inserts were necessary to reproduce the countries, forty-five pieces in all being necessary to complete the job. And each had to measure up to the standards of perfection set by the customer.

And the thing to remember is that Scranton can begin and complete a job like this in its own plant.

a job like this?

— Showing the Geogrophic Educator taken apart into a few of its many sections—

The Scranton Button Co.

Plants Located at Scranton, Pa., and Auburn, N. Y.

Western Representative, Gordon D. Wilson 645 Washington Boul., Chicago, Ill.
New York Office, 50 Union Square Arthur F. Wiseburn, Manager
Ohio Representative, J. E. Black & Co. The 4900 Euclid Bldg., Cleveland, Ohio

Knowledge Every Buyer Should Have

(*Continued from page 336*)

and shock resistance are always to be considered. Then again, the character of the organization supplying the molded products should be taken into account. The buyer should assure himself that they have sufficient financial responsibility to carry through any engagement that they make; also that they have the equipment and skill necessary to turn out a satisfactory job, within the time specified. In some lines of business a delay of a week or two in delivery may tie up many thousands of dollars worth of merchandise. Generally speaking, the factors of technical service and ability to keep promises of delivery, are more important than initial low price. Perhaps the most commonly repeated criticism of some suppliers of molded insulation has to do with failure to live up to their promises of delivery.

Mold Costs

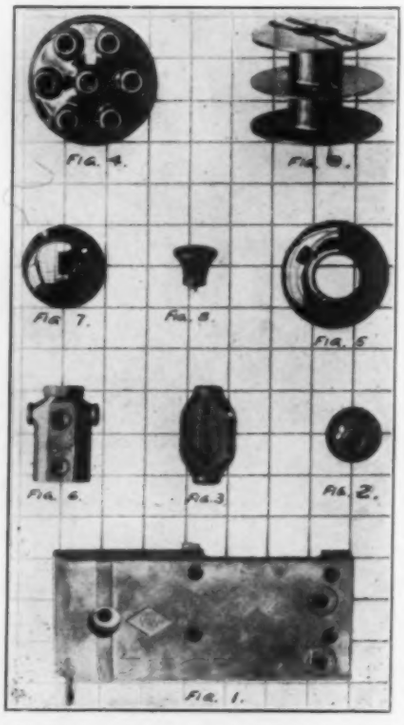
The buyers should know how to interpret the quotations that are furnished. Moreover, the basis on which the quotation is figured should always be clear. If one manufacturer quotes $350.00 for molds as against, say, a quotation of $600.00, it should not necessarily be taken for granted that these two quotations cover exactly the same thing. One quotation may mean only a four-impression mold, as against an eight-impression in the second instance. On the other hand, one quotation may refer to hand molds, and the other to automatic molds. In many cases, higher mold costs might be in the end more economical, by insuring a larger output per day, and giving the purchaser a reserve supply of product for seasonal orders.

The purchaser should also ascertain what the quotations include with respect to the finished product. Some molders base their estimate on the product *as it comes from the mold,* without including any minor operations which may be necessary in making the part ready for customers use—drilling, tapping of holes, etc.

It is well for a purchasing agent to assure himself that a molder has a well organized inspection department, so that delays and production hold-ups will not result from the molders shipping parts that will not pass the customer's specifications. Laxness in the molder's inspection department may often be costly to the buyer.

Too great a nicety in the matter of tolerance should not be insisted upon, except where absolutely essential. In most cases leeway of plus or minus .005 is all that is really necessary.

Greater accuracies than this can be obtained, but it means a longer time in the molding operations, and more exacting inspection, all of which adds to the cost of the piece. Inspection service, where exact dimensions are specified, usually entails careful checking with gauges or templets. It also means a larger number of rejects, and this is naturally reflected in the ultimate price of the product.



An assortment of molded parts described in the article:
Figs. 1, 2, 3, 8, cold molded
Figs. 4, 5, 7, 9, hot molded
Fig. 6 made in part from each class.

One of the factors which is perhaps not fully appreciated by the average buyer of the molded insulation, is the length of time required to produce the necessary molds. In many cases, a busy molder when urged by the purchaser will produce a mold in two or three weeks, whereas if he were allowed four to six weeks, a better mold job would be furnished, and this in turn would lead to a better product for the customer.

Excessive demand for quick delivery, often results in a forced promise, and subsequent failure to deliver on time. The buyer usually gains little by extracting from the molder a promise of much quicker delivery than was originally deemed possible.

The matter of quantities has, of course, an important bearing upon the price. It is impossible, however, to state any general rule, or general unit price, because that would necessarily depend upon the design and size of piece—factors which are by no means constant.

In general, the larger, the more attractive it is to the producer, and the better the price. It will be understood moreover, that when initial cost of design and mold products is distributed over a large order, the unit charge will be relatively low. In a consideration of price, the quantity of order is of little significance, unless the design of molded part is likewise defined. An order for 1000 pieces weighing a pound each would be quite attractive to the average trade molder, while an order for a similar quantity weighing a fraction of an ounce each, would be regarded with much less enthusiam. It is correct

(*Continued on page 350*)

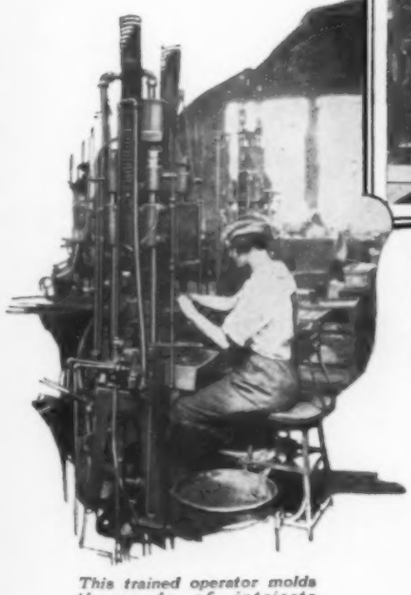
This Mass Production Means Lower Costs

The facilities of G-E molding plants, which have produced millions of Textolite Molded parts for use in G-E products, are now available to the entire industry.

Careful research, the best of materials, and skilled design combine to produce superior molded parts at low cost. Five years of experience, in which G-E made more than 375,000,000 pieces, have brought production methods to highest efficiency. The resources of General Electric make these plants a dependable source of a high-grade product.

If you need custom-molded parts of proved reliability and economy, telephone your nearest G-E office.

A production aisle in the hot-molded department. Note that the most modern equipment is used to decrease manufacturing costs by scientific mass production



This trained operator molds thousands of intricate pieces every day. Hundreds of such operators are needed to meet the demand for G-E Textolite Molded

An aisle in the cleaning department. After cleaning, the beautiful polished pieces are ready for packing

GE Textolite Molded

885-12

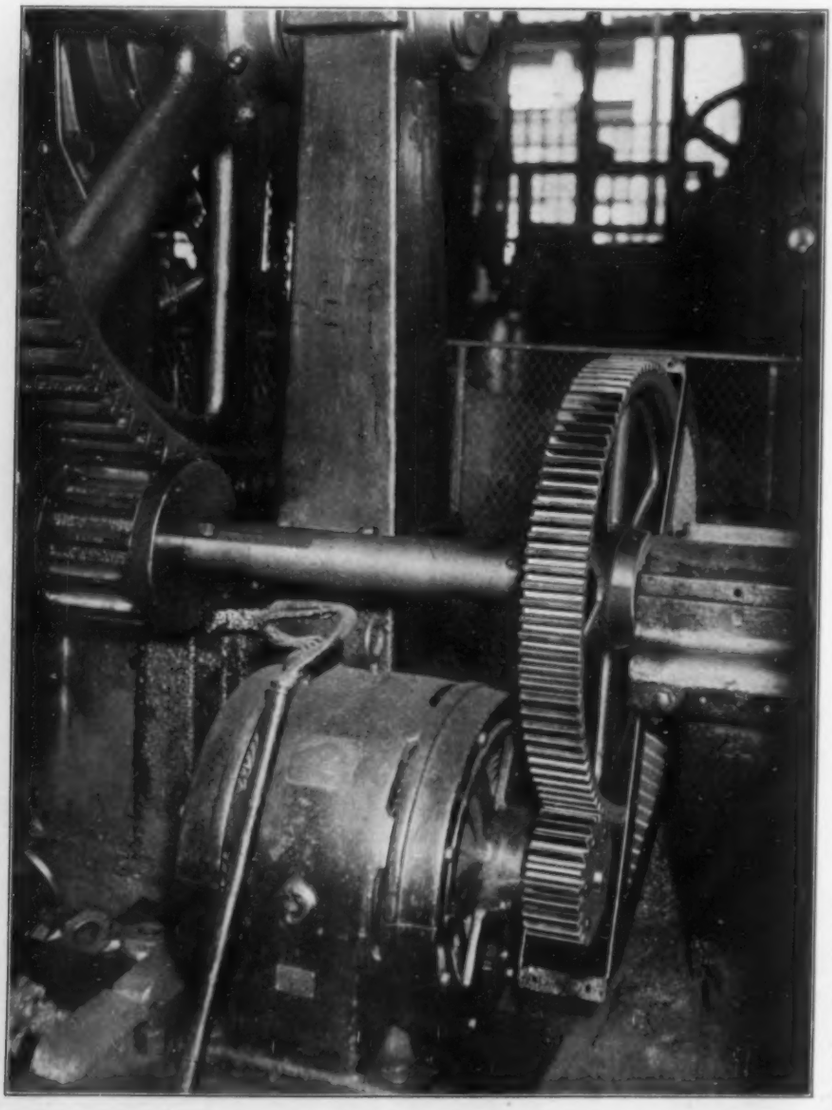
GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

Laminated Gears In Industry

Contrary to the usual lay idea, laminated gears are in use for other and much heavier duties than auto timers

The extensive use of Bakelite Laminated gears in the timing gear train of automobiles is paralleled in the industrial field by the use of pinions on motors driving nearly every type of machine. Bakelite silent gears provide what is probably the most efficient type of front-end drive for the automobile—all factors considered. This type of silent drive has been commended as most compact, lightest, most durable, and least expensive. There are no adjustments to make as in the case of a chain drive, and there is no stretch to effect the timing of the motor.



Spur Gear on this motor is Bakelite Laminated
(Cut through courtesy of Bakelite Corp.)

Heavy duty pinions operating on motors driving industrial machinery, frequently outwear metal, and provide additionally the factor of silence. Laminated gears frequently replace cast iron bronze, and forged steel. Such replacement is especially advisable in abrasive plants where the presence of grit in the atmosphere proves destructive to metal.

Although laminated gears are resilient, they are self-supporting, and except where conditions of heavy starting torque are encountered, they require no side plates or shrouds. In the timing gear train of an automobile it is especially important that the gears be self supporting, since space is at a premium and requisite strength must be available in a gear of small face.

Industrial Applications

On motors ranging from a fractional horsepower to 100 hp., laminated pinions serve to drive practically every type of industrial equipment, such as broaching machines, crane bridge motors, reversing planers, vertical boring mills, engine lathes, open slide planers, punch presses, shears, milling machines etc.

The phenol resinoid constitution of the gears makes them proof against the ravages of vermin and rodents—an advantage over raw hide.

The resistance of laminated gears to heavy impact is indicated in the instance of a bevel gear used on a paste mixer, transmitting 15 hp., at 1200 r.

(Continued to page 349)

Use Siemon Parts

BRIDGEPORT, CONN.

The Siemon Company are exclusive moulders of Shellac compositions and compositions made from other natural gums. That other compounds are replacing this old material is a misconception as evidenced by the crowded condition of our Tool Room due to dies required for new work—articles which we have never made before. Automatic equipment, modern in every way, enables us to quote prices far below any other compound.

HOOSICK FALLS, NEW YORK

The Specialty Insulation Manufacturing Company are moulders of Colasta which is useable for all purposes and is a synthetic compound that is unequaled for moulding purposes particularly on account of its uniformity and its unusual physical characteristics. The Specialty plant with their own automatic presses made in their machine shop are especially equipped to quote interesting prices on volume moulding.

WATERTOWN, CONN.

The Watertown Manufacturing Company are manufacturers of both natural gum compositions and so-called phenolic synthetic compounds. They have a spacious modern plant making a large variety of moulded articles as used for the druggists—sundries, sporting goods, smoker's outfits, automobile, electrical users, and other branches of business too numerous to mention.

This plant has also absorbed the American Composition Company which was formerly located at Newark, New Jersey.

HOOSICK FALLS, NEW YORK

The Colasta Company inventors and manufacturers of the patented and perfected moulding compound of many characteristics is daily increasing its field of usefulness.

USE SIEMON PARTS

The Siemon Family

The Siemon Company
Bridgeport, Conn.

The Watertown Manufacturing Co.
Watertown, Conn.

The Colasta Company
Hoosick Falls, New York

The American Composition Co.
Watertown, Conn.

The Specialty Insulation Mfg. Co.
Hoosick Falls, New York

Mechanical Strength of Molded Parts Given Severe Test

This moulding job is called on to stand up under service conditions which calls for rugged construction

IN the mind of the average layman, phenolic resinoids are usually considered brittle. They are not credited with having any great degree of mechanical strength. This impression is not true however as all molders and most users of molded parts know. While it is true that this class of materials do not have the mechanical strength of steel, they do possess a surprising amount of toughness in some cases.

At the present time, there is being placed on the market, ash trays, wine sets, etc., which are practically unbreakable although molded with very thin walls. However, the material has been put to even more severe tests under conditions which call for much greater shock strength and has stood the test well.

One case in point is the car coupler shown in the illustration. This coupler is used on the cars in the Philadelphia subways. As shown, it resembles the regular type of coupler except for the two wings shown on the sides.

Set in Metal

The main body of these wings is made of metal, the same as the rest of the coupler. However, each of these metal wings enclose a molded part which has embedded in it fourteen metallic inserts.

The purpose of this arrangement is to make electrical contact from car to car of the various wiring devices. In all, there are twenty eight contact points molded in as inserts. These must be spaced properly so that they will make the proper contact when the car is connected to another.

The very fact that molded parts can stand up under the rough usage accorded a car coupler should answer most of the questions regarding its mechanical or shock strength.

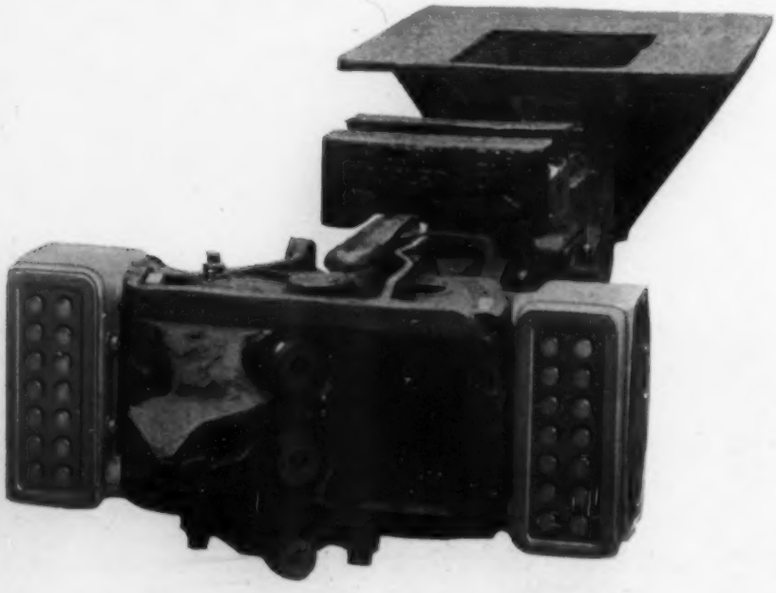
Of course the main reason for the use of phenolic resin material in this instance is its electrical properties. In order to get a material for the use shown here, it was necessary first that it should have good insulation qualities. These contact points carries comparatively high voltages and any insulating materials used would have to possess good dielectric qualities.

Molded Inserts

Another reason for the selection of phenolic compounds on this job is the ease with which metal inserts can be molded in. As pointed out above, it is essential that these inserts be set accurately since they must make contact with other inserts in the companion coupler. By the use of this material, it is possible to turn the completed job out of the mold in one operation. Ths saves drilling, tapping and other operations in order to get the inserts properly placed.

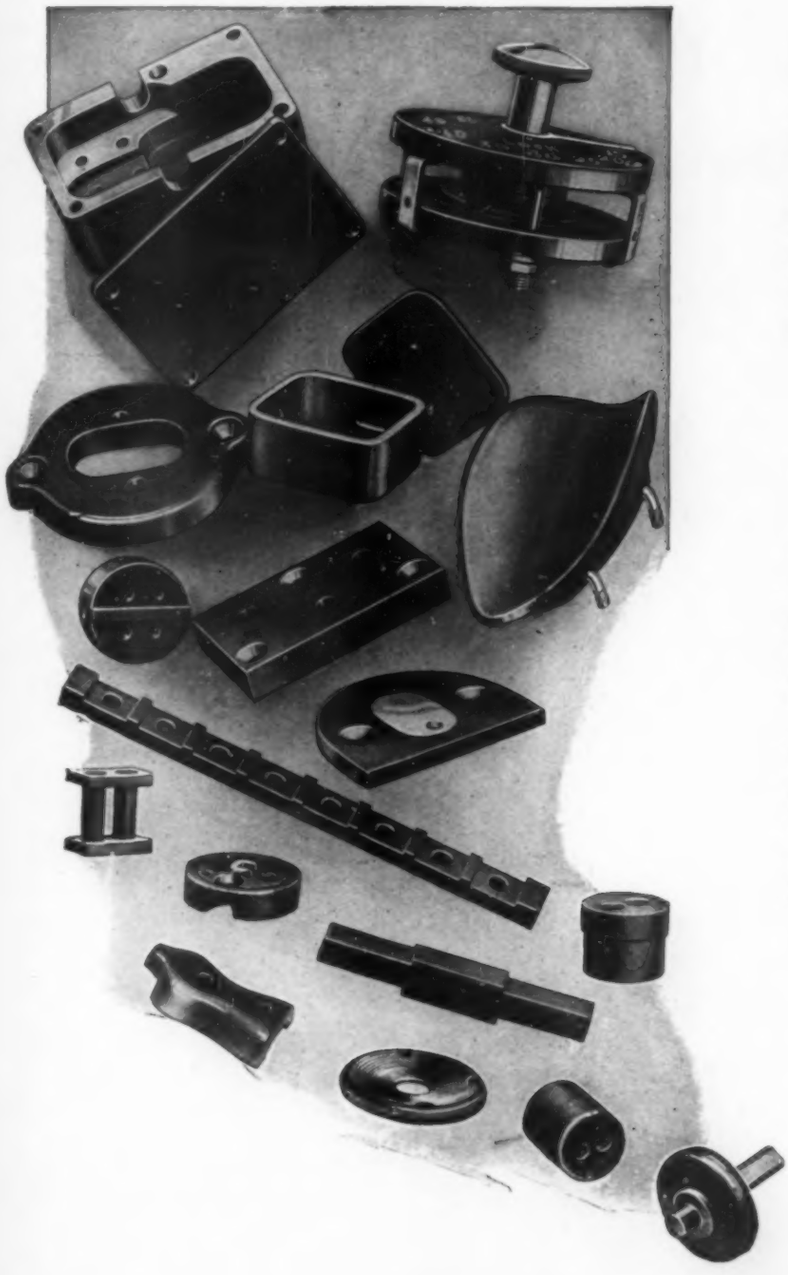
To sum up the advantages of phenolic resinoid molding compounds for this job, it has the proper insulating qualities, it

(*Continued to page 353*)



Complete car coupler showing molded parts

Parts for Many Industries



We Produce Molded Parts for Over 30 Industries

To You--- We Offer Quality and Service plus 35 Years' Experience

---

SHAW INSULATOR CO.

IRVINGTON, NEW JERSEY

Established SHAW 1892

Phenolic Resinoid Bond Used in Making High Speed Grinding Wheels

Modern production methods call for more speed in grinding operations. This is obtained with safety by present high speed wheels.

IT has been said that a Ford car manufactured by former methods would cost as much as a Rolls-Royce does now, were it not for grinding. The satisfactory operation of motor cars, busses, tractors, trucks, and airplanes depends in a measure upon the accuracy attainable in the fitting of their moving parts. Grinding methods of today produce a high degree of precision with rapidity and at relatively low cost.

Just as chemistry, physics, and allied sciences have modified and controlled the properties of steel, so have they contributed toward improved abrasives and grinding wheels. Essentially a grinding wheel consists of hard, angular grains of abrasive bonded together in such a way that each grain gives a maximum cutting service before dulling or breaking away.

Grinding Makes Speed

In 1904 there was not one grinding machine in the automobile industry. Today there are 68,000. In 1904 five hours were required to turn, make fillets, and file the four pins of an automobile crank-shaft. Today grinding methods produce a better product in five minutes. Probably $8,000,000 worth of grinding wheels are used each year in the manufacture of automobiles.

Spark plugs would not ordinarily be thought to involve grinding, and yet some of the largest manufacturers of these products use grinding wheels to give the raw porcelain blank the proper shape so that, after firing, it will fit accurately to the metal parts of the plug.

Problem of Harder Steel

The grinding machine is the only tool known which is capable of reproducing in the material

which is being shaped the accuracy that has been built into the machine tool itself.

The metallurgists and the Chemists have been continually making tougher and harder steels that cannot be satisfactorily machined, but must be shaped as well as finished to size by grinding. The surface defects in billets of soft carbon steel are chipped away, but the defects in modern alloy steels must be ground out.

Types of Abrasives

Natural minerals were the first abrasives used by man—quartz (often in the form of sandstone), garnet, emery, and corundum. But the grinding action of each of these was variable; their composition and structure could not be controlled. It remained for the chemist to develop artificial abrasives which could be made to specifications and maintained uniform in properties.

Today, there are two classes of artificial abrasives, both products of the intense heat of the electric furnace: the one consisting essentially of crystalline aluminum oxide and represented by such trade names as Alundum and Aloxite; the other composed of crystalline silicon carbide and known by trade names such as Carborundum and Crystolon.

Types of Bonds

Various bonds are employed to hold the abrasive grains to-

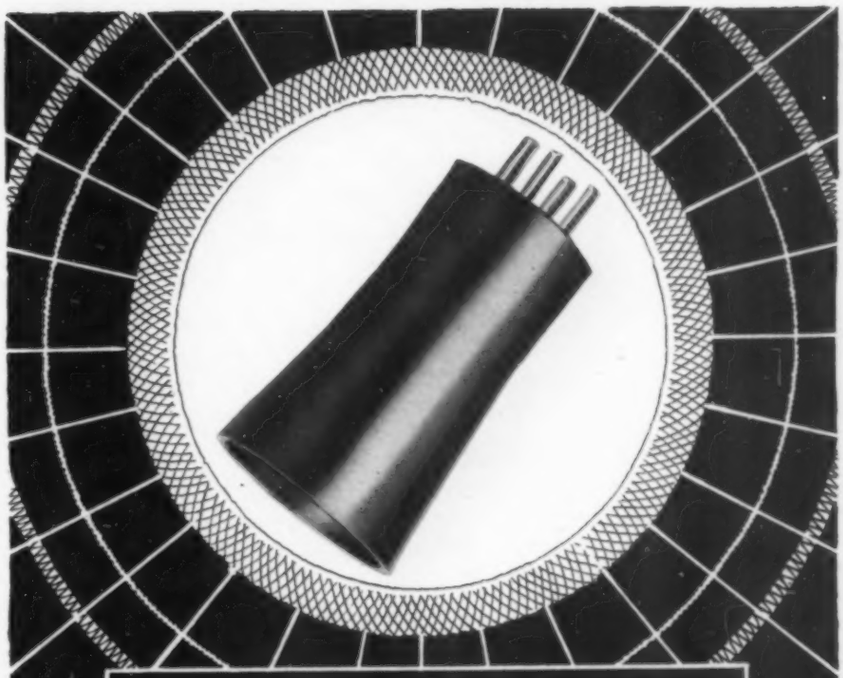
gether in the grinding wheel, and the resulting wheels have different properties and are for different purposes. "Vitrified" bonds are made of mixtures of clays and feldspars, and the wheels are fired in ceramic kilns to mature the bond to a glass. "Silicate" bonds are essentially sodium silicate, zinc oxide, and fillers. Shellac, hard rubber, and synthetic resins, such as Bakelite constitute the "organic" bonds commonly employed.

The wheel which operates best is usually one that wears just enough to keep itself sharp, but not so much as to be wasted away too rapidly. To attain this result for different grinding operations requires that the abrasive grains be bonded together with various degrees of strength in different wheels.

Grinding wheels are being run at higher and higher speeds in order to obtain increased rates of production. Wheel bonds must be made stronger, tougher, and more uniform in order to maintain a sufficient factor of safety at the high speeds. Much progress has been made along these lines, and more will probably follow. Bakelite bonded wheels for rough grinding of steel castings so-called "snagging" have recently been announced which can be safely operated at 9,000 surface feet per minute, compared with 6,000 surface feet for similar vitrified-bonded wheels, and are therefore capable of developing 50 per cent faster cutting action.

The uses of the artificial resin bonds are being extended. The fact that they have reproducible and controllable properties is an added advantage. Shellac-bonded wheels were formerly used for grinding ball races in a certain factory, and one wheel would grind an average of ten races. Today a Bakelite-bonded wheel has been developed that is more suitable for the operation and will grind from one hundred and fifty to two hundred races.

Reprint from Journal of Industrial and Engineering Chemistry, October, 1927.



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New Idea in Harmonicas Produced by Use of Molded Parts

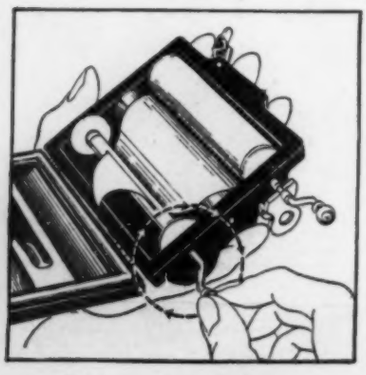
This article formerly made of cold rolled steel, now being produced at lower cost and of improved appearance from phenolic compound

ATTENTION has been called from time to time to the use of plastics and molded products in the musical field. This use runs all the way from piano and organ keys covered with ivory grained pyroxylin to molded mouthpieces of phenolic compounds for reed instruments.

Plastic materials are used for these purposes for various reasons. In the case of pyroxylin key tops they are used to replace genuine ivory which yellows badly and cracks with age. In making mouth pieces the molded job can be turned out more accurately and does not need frequent polishing as is the case of metal.

There seemed as though there would be an end sometime to the kind of musical instruments in which plastics would take a part, but now with the evidence before us we are ready to agree that there is no limit.

Probably the latest use of molded products in this field is the Rolmonica. This is our old friend the harmonica or mouth organ brought up to date. By making use of rolls similar to player piano rolls anyone can play a tune on this instrument.



Closeup of instrument

The rolls are fed into the Rolmonica and the operator merely turns the handle and exhales and inhales his or her breath through the mouth piece to produce the tune.

Molding materials have been adapted by this manufacturer for the following reasons. Some forty operations have been eliminated by having it molded. This article was formerly made of cold rolled steel. One can readily imagine the number of operations necessary to duplicate the article shown from metal.

Many Advantages

In addition to the time and money saved on labor, molding materials also gives the following advantages. Good appearance, it is non-warping, it is completed when molded, weight is materially-reduced, and better sounding value materially increased.

Appearance of course is achieved by the use of colored molding powders which with their high lustre when turned out of the mold give a decidedly novel and rich appearance to the finished article. To attain this same effect with metal would require additional spraying of lacquer or enamel at added cost.

The fact that molded parts do not warp was also a big advantage. The usual type of harmonica has the metal sounding reeds attached to a wooden block which slowly becomes soaked with moisture and warps out of place. Phenolic compounds being nonhydroscopic do not have this serious defect.

Rolmonica in use

In molded form this article is practically complete as it comes from the mold. This not only eliminates a lot of costly labor, but enables the manufacturer to get a more rapid turnover on his money by cutting out of waste motions from the time his money is spent for the raw material until he receives the customers money for the finished product.

To one who knows absolutely nothing about the problems of the harmonica manufacturer or the chances for quality in their production this thought occurs. If it is possible for molded products to achieve so much in the way of manufacturing and sales value for such a homely little instrument. Where is the limit for the use of this type of material?

This article is being produced of Bakelite by the Rolmonica Music Co., Baltimore, Md.

p. m. This unit ran five months in a drive with the shaft out of line. Although full load was unevenly distributed on the teeth, there was no fracture even after the teeth had worn half through.

Gear Types

Spur, helical, mitre, worm, and herringbone gears are successfully cut in the usual sizes and pitch. The cutting is accomplished with the use of shaper, hobbing machine, or milling machine. Choice of machine depends on the nature of the work or equipment of the shop. In cutting a gear some machines cut each tooth individually, while others (generating type) progressively cut out the gear teeth by automatic operation. Gears of thin face can be fabricated in multiple by operating as if a single thick gear blank were being cut. To secure most accurate gear cutting, the teeth are first cut, and then finished —by roughing and finishing machines.

The last blank in a series, or the side last cut in a single gear, must be backed up by a plate to prevent the cutting tool breaking through and fraying or splintering. Backing plates can be of hard wood. In quantity production, a metal plate is desirable. It should be so designed that the operator can rotate it in relation to the cutter teeth after gear blanks have been locked in place.

Installation

A laminated gear should always be run in mesh with metal gears, never with other nonmetallic gears, nor with metal gears having uncut cast, or badly worn, teeth. The face width of the mating gear should be equal to, or greater than, that of the laminated unit. It should never be less.

When run with metal gears, laminated gears have been found consistently to increase the life of the combination over that of all metal trains. Nevertheless, faculty installation or irregularities in the metal contour may of course, cause trouble. This can be overcome by proper care in installation.

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Knowledge Every Buyer Should Have

(*Continued from page 340*)

to state, however that a molder usually makes very little profit on orders of less than 5000 pieces.

It is common knowledge that the molders make no profit on the molds. On the contrary, molds frequently cost them more than the price quoted, their only profit being on the molded parts produced. In some cases a molder will purposely under-quote on a mold, in the expectation of making up the loss in the piece price of product on orders of appreciable size.

There is no general understanding as to who owns the molds. If the customer pays for the molds he is supposed to own them—at least theoretically. Some manufacturers make the condition, however, that they must receive orders for a certain minimum quantity of parts from the molds before they will turn them over to the customer. Other molders regard the molds as their particular property, notwthstanding the fact that the customer has paid for them, and they will not, under any circumstances, turn them over to the customer. There are still other molders who take a quite different attitude and surrender the molds to the molds to the customer on demand. There is

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Which Will
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Monthly

no doubt than an injustice is sometimes done the molder by this latter practice. A mold represents more than so much steel and machine work. It often embodies considerable skill in the matter of design, thereby enabling one manufacturer to produce more cheaply than another. The molder quite naturally feels that this particular skill is part of his stock in trade, and he is reluctant to turn molds over to a competitor who may then derive the benefit, without having contributed in the initial development.

Trade Practice

In the drop forging industry, it is said to be the practice to regard the molds as the property of the manufacturer even though the customer pays for them. Such a convention can become so well recognized that it is accepted as a trade practice. Possibly, at some future time, a similar practice will apply in the plastic molding trade.

Knowing the important characteristics of the several types of plastic materials, the general method of molding, and typical industrial uses of each product, the purchasing agent in cooperation with his company's engineer will properly be in position to determine what type of plastic he should specify. The fact that plastics have replaced practically every known material of construction in the making of some commodity or other, does not signify, of course, that they are the ideal solution for all the problems of production. It does indicate, however, that when present production is being made in wood, metal, fibre, porcelain, etc., the possibility of converting this production to the best type of plastic for the particular work, will no doubt be considered eventually.

Assuming that most purchasing agents are highly familiar with the properties and uses of the older materials of construction, such as wood, stone, and metal, they will find it increasing valuable to be fully informed of the properties of plastics and their range of uses. A study

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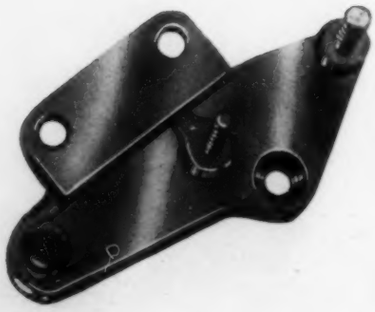

of the applications of such materials in the general mechanical and electrical fields as well as in the automotive industry, will serve as good guidance.

Reprint from May 1928 number of The Purchasing Agent.

Color in Magnifying Glasses

The little pocket magnifier which has been turned out for years with either a brass or dark pyroxylin frame has at last blossomed out in color. The Bausch & Lomb Co., now announce that their small pocket magnifier, which was formerly made with a demi-amber pyroxylin frame can now be had in red, green, violet and orange. This is just one more instance where the lesson learned in the fountain pen and other merchandizing fields is being put to work. The public wants color and the public has to be pleased. Color sells.

New Works Manager For Celluloid

W. Stuart Landes of 194 North Oraton Parkway has been appointed works manager of the Celluloid Corporation of Newark, to succeed Harry Soper, who will become vice-president of the organization. Mr. Landes, who was graduated from the University of Pennsylvania as a chemical engineer, was awarded the Distinguished Service Cross, Legion of Honor and Croix de Guerre during the World War.

Importer of Cellulose Acetate Opens New Office

Mr. Irving Puttmann of No. 1 Boulevard Haussman, Paris, has opened offices in the Graybar Building 420 Lexington Avenue New York, specializing in the sale of Cellulose Acetate and its products. Mr. Puttmann has also been appointed General Agent and Distributer for the Meta S. A. of Basle, Switzerland, in the territory of the United States and Canada for the Meta Appliances and Meta Safety Fuel manufactured by the Lonza Electro Chemical Works and maintains a warehouse for that purpose at 122 Fifth Ave.

Mechanical Strength

(*Continued from page 344*)

saves time and labor in fabrication due to ability to mold in the contact points. And last but not least, it is tough enough to withstand the bumps and jars of the service to which this article is put.

This job is only one of the widespread uses made of the phenolic compounds in everyday life. It is not used in such a way that it comes to the attention of the general public as would be the case if it were made up into a cigarette holder or auto gear shift ball. However, it does fill its place much in the same manner as phenolic boded grinding wheels.

This job is being done for the Van Dorn Coupler Co., by the Chicago Molded Products Company.

Molded Products Used in Making Globe Atlas

(*Continued from page 337*)

The child can learn and the grown-up can refresh his memory by playing with these inserts. While playing with the inserts, the mind gradually absorbs the proper locations of the various countries without conscious labor.

It is new jobs of this nature that keeps the molding industry constantly on the upgrade. There is always something new to be turned out; some job to be done which displaces another material or some new device which could be made of no other known type of material.

This interesting job is being done by The Scranton Button Company for the Geographic Education Corp., 208 Rawson St., Long Island City, N. Y.

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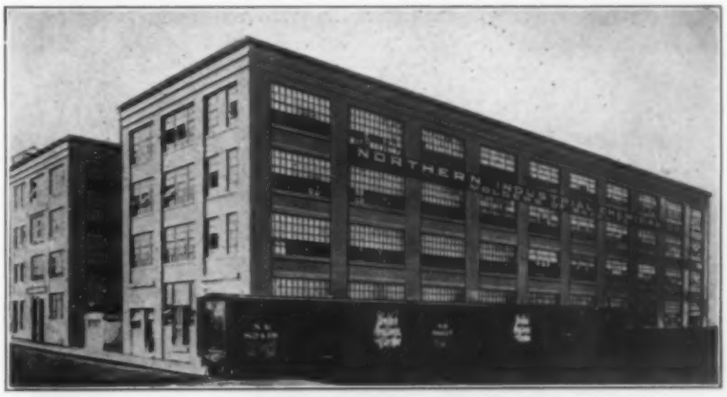

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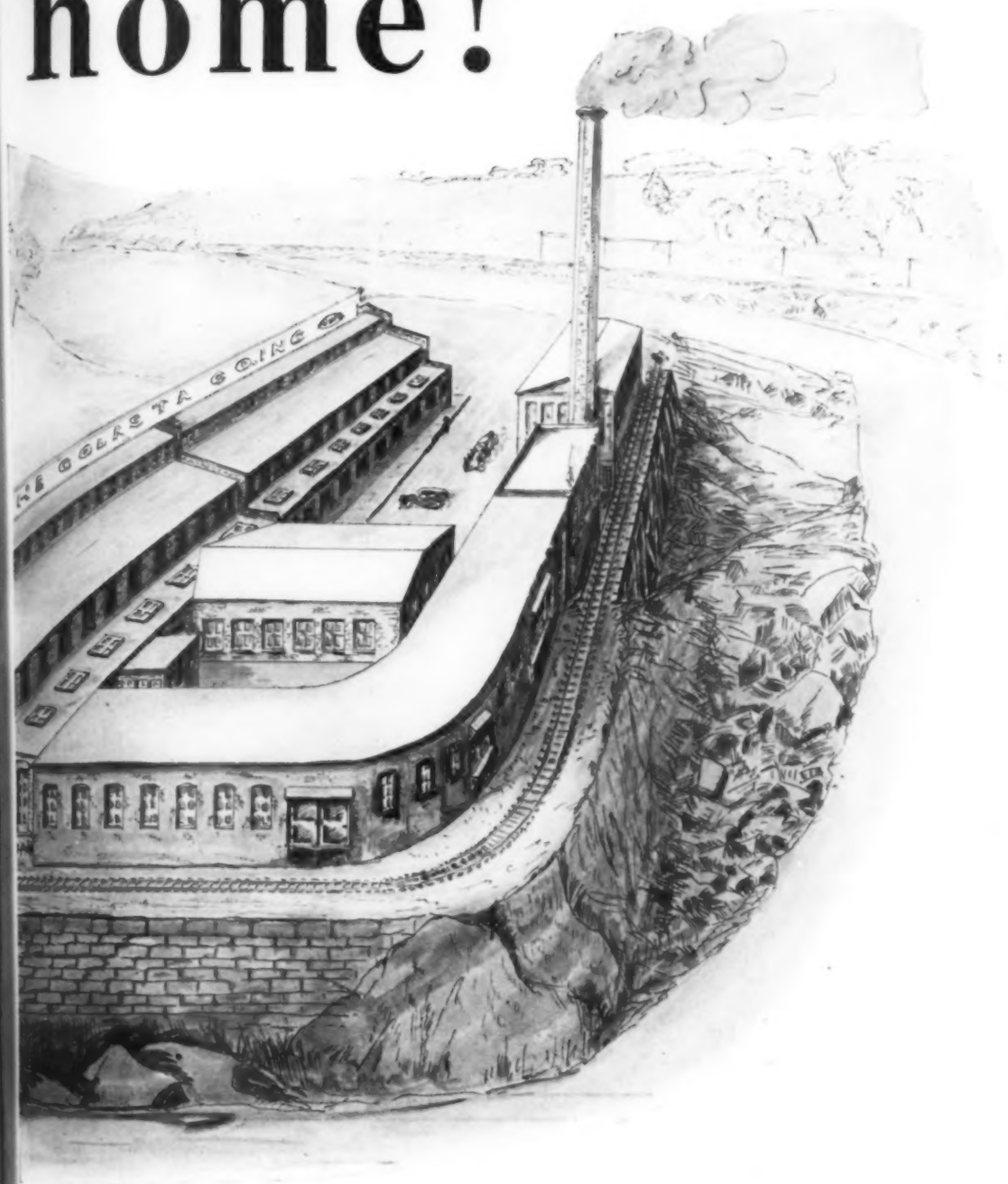

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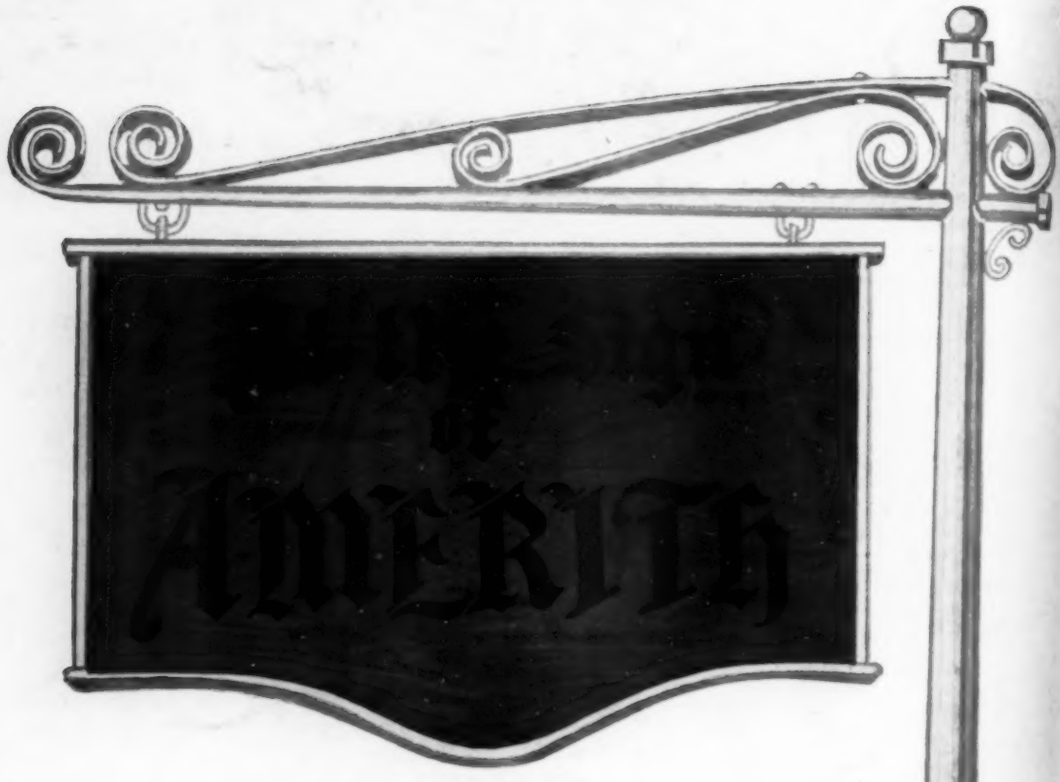

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Chicago

97 Water St.
Leominster

340 Sansome St.
San Francisco

188 Morris Ave.
Providence

52 Chauncy St.
Boston